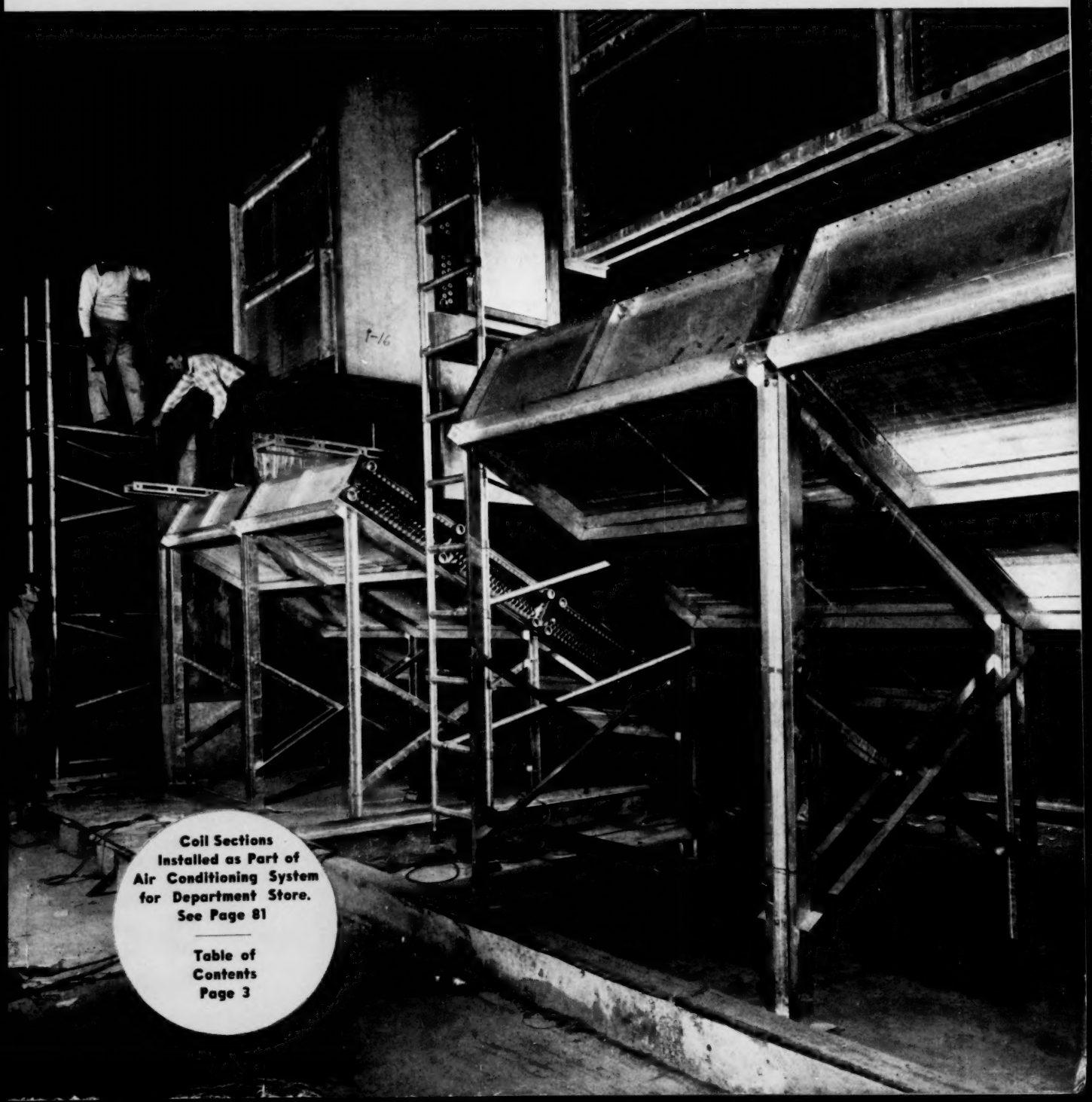
AIR CONDITIONING HEATING AND VENTILATING

NOVEMBER, 1956—53rd Year



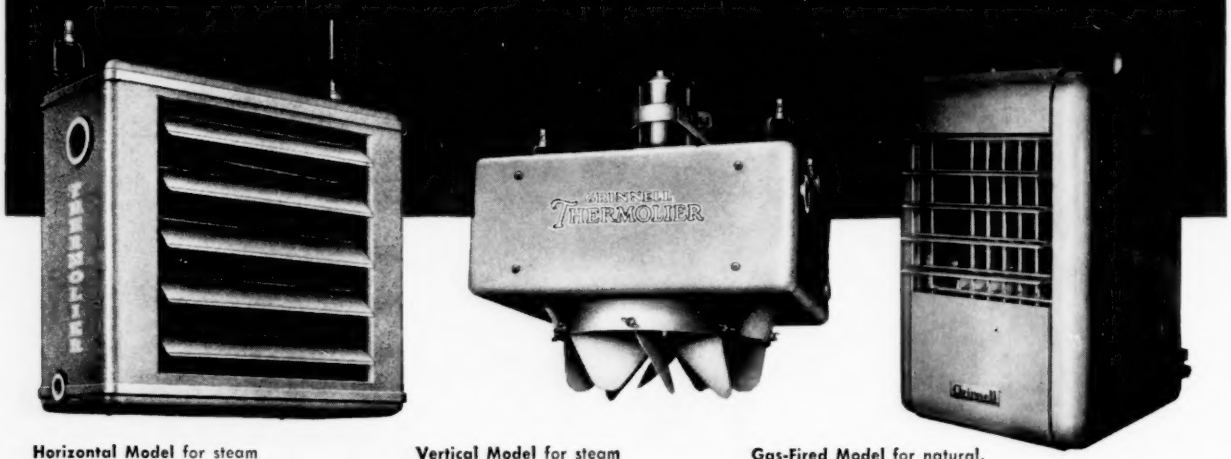
Coil Sections Installed as Part of Air Conditioning System for Department Store.
See Page 81

Table of Contents Page 3

For Maximum Heating Comfort, Economy, and Flexibility...

Grinnell Unit Heaters bring you many unique design and construction features, coupled with important advantages in comfort, economy, and ease of heating. Heat comes fast, even from a cold start — and is spread uniformly to all parts of the working area. It is not allowed to bank up uselessly under the ceiling. Units are compact. And, both unit and the simple piping are overhead, out of the way, easy to relocate if necessary. Heating capacity often exceeds that of other types costing twice as much.

GRINNELL UNIT HEATERS



Horizontal Model for steam or hot water systems.

Vertical Model for steam systems.

Gas-Fired Model for natural, manufacturered, mixed, LP gases.

GRINNELL THERMOLIER
Steam/Hot Water Unit Heater
4 models . . . 18 sizes — from 35,600 to 275,300 total heat delivered, Btu per hour

Three basic models—horizontal, vertical, and a special horizontal Textile model. (Adjustable velocity nozzle also available for use on horizontal models.) All models have plain thermostatic trap, the simplest and least expensive kind of a trap, made practical because of unit's exclusive internal cooling leg; maximum capacity provided and destructive water hammer eliminated by built-in pitch of tubes. Many other important features.

GRINNELL
Gas-Fired Unit Heater
Available in 7 sizes — ranging from 25,000 to 200,000 Btu per hour input

Grinnell Gas-Fired Unit Heaters are easy to install, simple to operate and maintain. Efficient performance is assured — with any type of gas — by modern design of burners and heat exchanger, proper motor and fan unit. Automatic safety pilot operates to shut off main gas supply if pilot goes out. Flashback and extinction noise prevented by the burners' raised port design and proper port size for the gas used. American Gas Association approved.

Available from your local distributor

Grinnell Unit Heaters are backed by over 60 years of heating experience, and proved by trouble-free service in countless installations. They are distributed by a coast-to-coast network of plumbing and heating jobbers . . . and in over 30 principal cities, Grinnell engineers can offer on-the-spot advice and help on your heating problems. For new buildings, or for modernizing existing heating systems, it makes good sense to call on Grinnell first — for the unit heater that will meet your specific needs.

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WHENEVER PIPING IS INVOLVED

Grinnell Company, Inc., Providence, Rhode Island

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Here's the rugged, heavy-duty answer to condensate and air removal needs in air conditioning coils, unit heaters, fan heater coils, drips of mains, blast radiation or hot water generators. This all-new Webster Series 27 Float-and-Thermostatic Drip Trap provides these important advantages:

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- Long, trouble-free life is assured by rugged construction of stainless steel valve, seat, bracket and float lever . . . and cast-iron body and cover.

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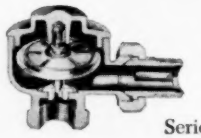
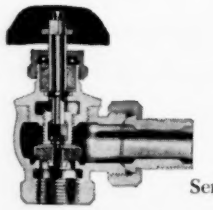
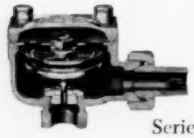


Series 9 Thermostatic Trap



Series 10 Radiator Valve

Size 782 Dirt Strainer



Series 78 Process Steam Trap

Other Webster Steam Heating Specialties include Lift Fittings, Double Service Valves, Boiler Protectors, Expansion Joints, and Trap Attachments. Descriptive bulletins on request.

AIR CONDITIONING HEATING AND VENTILATING

NOVEMBER, 1956

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CONTENTS

VOL. 53 No. 11

FEATURE ARTICLES

Modernizing a Department Store Air Conditioning System—J. H. Jerrell, I. Isaacson 81
Successful Refrigerant Piping—F. K. Ladewig ... 85
Packaged Water Chillers for Air Conditioning—Part 2—G. B. Priester ... 92
Calculating the Heat Requirements of a Snow Melting System—Part 3—W. P. Chapman 96
The Case of the Air Conditioning Fountain—E. J. Updraft ... 100
Consulting Engineers Tighten Mechanical Specifications—H. Terry ... 125

SHORT ARTICLES

Check List for Steam Pressure Regulator Station ... 91
Ceramic Is Humidity Sensing Element ... 99
Computing Device for Water Content of Gases ... 116
Supporting Insulation Blocks ... 126

REFERENCE MATERIAL

Section—Frequency Response Methods—W. G. Holzbock ... 103
Data Sheet—Saturation Properties of Freon-12 ... 117
Detail Sheet—Discharge Line Gas Equalization; Automatic Purge Unit Piping for Freon.. 119

DEPARTMENTS

High Spots ... 5
Washington Overtones—L. Overman.. 6
Briefly Stated ... 10
Piping and Plumbing—L. Blendermann 114
Ad-Digest ... 121
News of Equipment and Materials ... 127
Product Applications ... 138
Degree-Days for September, 1956 ... 140
News of the Month ... 144
New Catalogs ... 150
Canadian Degree-Days for September, 1956 ... 160
Book Reviews ... 160
Coming Events ... 166

The Cover: Six coil sections, each served by a blower, were installed to serve the air conditioning system in Shillito's, a department store in Cincinnati, Ohio. See page 81.

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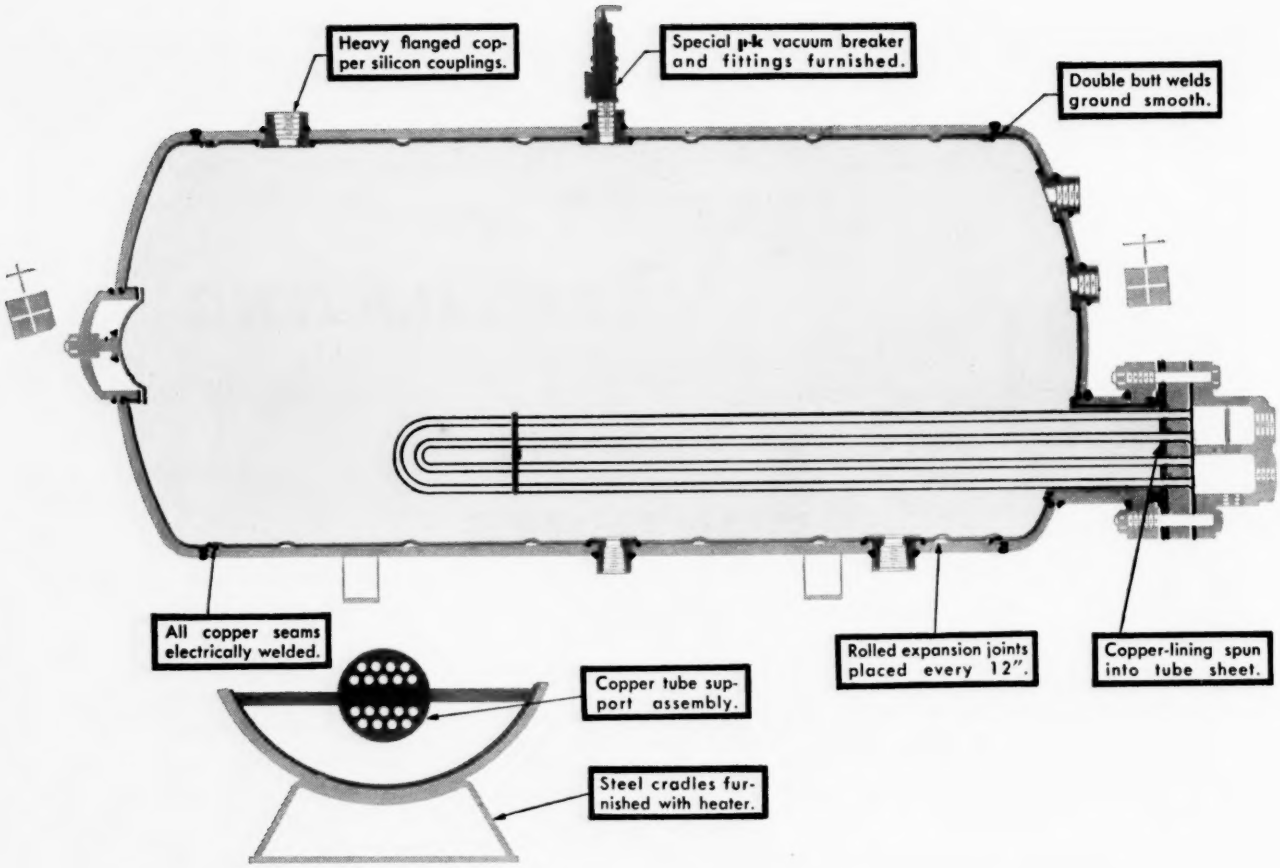
Heavy flanged copper silicon couplings.
Special p-k vacuum breaker and fittings furnished.
Double butt welds ground smooth.
All copper seams electrically welded.
Copper tube support assembly.
Steel cradles furnished with heater.
Rolled expansion joints placed every 12".
Copper-lining spun into tube sheet.

WHAT TO LOOK FOR IN A *Copper-Lined* HEATER

Nearly everyone knows the advantages of a copper-lined heater. Few realize the importance of the design features that are essential to long life and trouble-free service.

When you have manufactured a quality product for more than 40 years... built more than any other fabricator... and have thousands of successful installations from coast to coast, you know that product: how to build it *right* . . . economically . . . and with every possible design feature that 40 years experience shows is necessary.

Some of **p-k**'s experience is indicated in the diagram above. In the lining of this **p-k** heater, for instance, rolled joints are used at regular intervals around the full circumference, to allow for longitudinal expansion. Heavy flanged copper silicon couplings are securely welded to both the shell and the lining.

Standard equipment includes a special **p-k** vacuum breaker to protect the lining from sudden pressure fluctuation.

Another very important point is the testing of all **p-k** copper-lined heaters to insure long trouble-free service. Separate hydrostatic and pneumatic tests are made to guarantee leak-proof linings.

Experienced engineers know these points are critical. They know, too, that there is no substitute for this painstaking **p-k** type of construction . . . and that *insisting on* and *specifying* these construction points in copper-lined heaters justifies itself over and over again.

For complete copper-lined data write to The Patterson-Kelley Company, 1010 Burson Street, East Stroudsburg, Pa.

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Offices: 101 Park Avenue, New York 17 • Railway Exchange Building, Chicago 4 • 1700 Walnut Street, Philadelphia 3 • 96-A Huntington Avenue, Boston 16 and other principal cities

HIGH SPOTS

• Philco 1957 room coolers include a model having a device, the Ionitron, for **negatively ionizing the air** for the relief of hay fever patients, studies at University of Pennsylvania hospital having established efficacy of such ionization. Ionitron is in four sections including aluminum mesh filters, charger, and activated charcoal filter.

• Plans are progressing rapidly for 13th International Heating and Air-Conditioning Exposition and 63rd annual meeting of the ASHAE to be held in Chicago the week of February 25, 1957. Meeting will include two symposiums—**industrial ventilation and dehumidification.**

• New York Steam Corporation reports new buildings using or which will use **purchased steam** include new Tishman aluminum-faced 38-story office building on 5th Ave., 52nd to 53rd St., with steam-driven turbine cooling system; new C. I. T. home office on Madison Ave., also turbine-cooled; Peter Doelger apartments on E. 72nd St., and the modernized 15 Broad St. Corp. building, also with steam turbines.

• Carrier Corporation will provide 100 refrigeration systems for Pacific Fruit Express Company **railroad cars** to be completed in January. The refrigeration units feature a 40% reduction in power requirements. Systems are all-purpose in that they heat as well as cool. A temperature range from —10 to 70 degrees is possible.

• Manufacturers' shipments of **compressor bodies** used in air-conditioning and refrigeration units were up almost 33% during the first six months of 1956, as compared with the same period of 1955, according to Geo. S. Jones, Jr., managing director of Air-Conditioning and Refrigeration Institute.

• Building problems rising from the **extensive use of windows and glass** in contemporary architecture will be critically examined at a conference November 14-15 conducted by Building Research Institute and sponsored by manufacturers of glass products, windows, and accessory devices, and their trade associations. Top-flight research specialists will discuss daylighting, control of heat gain and loss, air conditioning, and natural ventilation, among other subjects.

• National Union Electric Corporation will buy the assets of **Armstrong Furnace Company,** it was announced in Columbus, Ohio, October 3. C. Russell Feldmann, National Union Board Chairman and President, revealed that the company has acquired Armstrong's name and business in an all cash transaction.

• A long-range trend toward **larger sizes** in household **gas water heaters** is continuing, according to the Gas Appliance Manufacturers Association. Reasons: Bigger families, growing use of washing machines and dishwashers in the home, and more attention to personal grooming.

• New Community War Memorial Building in Rochester, N. Y., has 85 x 200 ft. **ice-skating rink** using 50,000 ft. of Byers wrought iron pipe. Engineers were Robson and Wolse, Inc., Syracuse.

WASHINGTON OVERTONES

by LORING OVERMAN

With elections out of the way, expect a brand new crop of policy outlines from Washington. Held in abeyance for many weeks because of their possible bearing on politics, **many new projects** may soon be influencing the lives and fortunes of those in air-conditioning, heating, ventilating and plumbing industries. For example, in the **Department of Defense:**

- Expect early announcement of increased budget requirements for fiscal 1958 . . . up approximately $2 billion from the 1957 fiscal year figure of $37 billion.
- Look for greater emphasis on "new" weapons—guided missiles, intermediate ballistic missiles, continued experimentation with intercontinental ballistics.
- Expect a companion **reduction of personnel,** together with their housing and ground transportation facilities.
- Plan on **stepped-up facilities** for the production of faster planes; replacement of obsolete types.
- Expect a **$39 billion defense program** to have important overtones in every industry—even those not directly concerned with defense contracts. Expect the program to be a major claimant of metals, machinery, manpower, and money—the latter a powerful deterrent to hopes of tax reduction.

* * *

Foregoing portrait of a large and steady customer suggests:

- Business not connected with defense must learn to live with it as a preferred purchaser.
- Firms in a position to serve defense industries will be interested in recent appraisals of the place of small business in the defense effort.

With small business, trend toward highly scientific gargantuan weapons automatically **reduces opportunities for small business** to share in principal phases of the program. So says Joseph McKellar, DOD Director for Small Business.

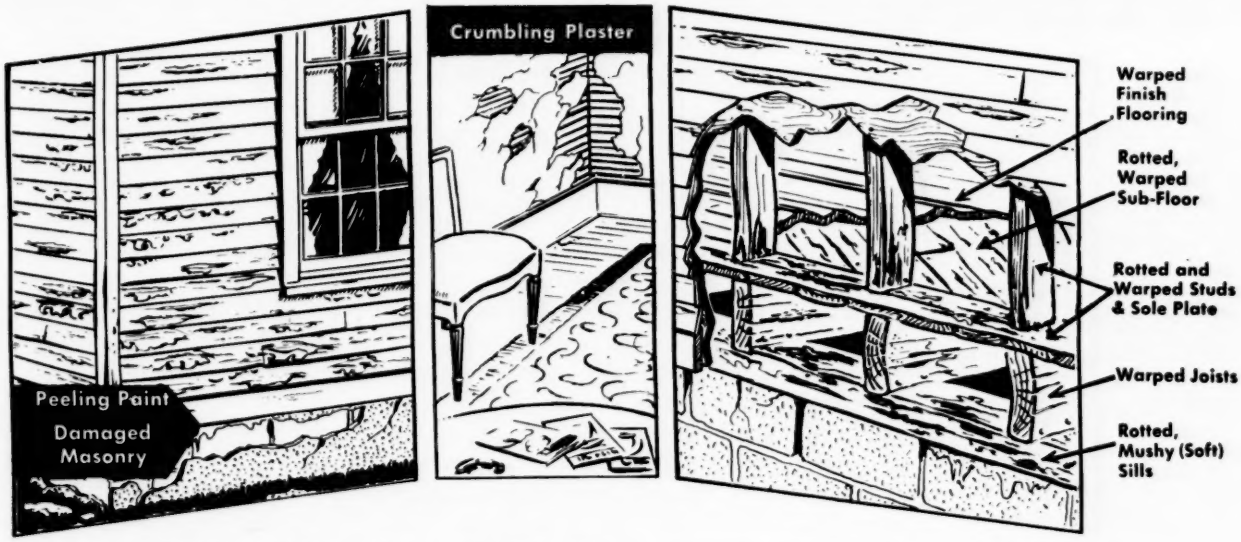
- This conclusion is borne out by Senator Sparkman's observation that the small business share of defense business in 1956 was only 19.6 percent of the total, as compared with 25.3 percent in 1954. The Senator, who is chairman of the Senate Small Business Subcommittee, suggests **30% as the proper target** for small business' share of defense contracts.
- How big defense over-reaches small business was spotlighted by DOD Small Business Director McKellar. Air Force Preferential Planning List, he said, catalogs 73 aircraft items costing more than $10,000 each, without a single small business supplier on record. Same is true, he said, of Air Force's nine guided missile items costing $10,000 each; and Navy's 54 aircraft items and 14 guided missiles.
- Conversely, McKellar said, small business is the prime beneficiary of the Defense Department's program for eliminating commercial and industrial facilities operated by the military. Some 2,000 such facilities are under review, with more than 350 business operations already eliminated.

But all is not gloom for small business.

- Small Business Administration has authorized its regional directors to approve small business loans up to $100,000 when a bank participates to the extent of at least 25 percent.
- SBA Administrator Wendell B. Barnes announced this move to speed up processing of loan applications. Prior to this action, SBA regional directors have been authorized to approve only $50,000 in bank participation loans. They may still approve only $20,000 in direct Government loads to small firms.

(Continued on page 8)

More Destructive than Termites!



CONDENSATION WILL MAKE PAINT PEEL, PLASTER CRUMBLE, WOOD ROT, AND MASONRY AND MORTAR DETERIORATE.

Insulation which is not protected by an adequate vapor barrier can allow considerable water vapor to flow into ceiling, wall and floor spaces, where if it condenses it may cause damage. It causes millions of dollars in repair bills annually. Vapor is a gas with 1/205,000 the density of water at 32°F. It flows from high vapor density areas to low.

Cold air can retain less vapor in suspension than warm air, and hence is an area of low vapor density. Vapor flows through plaster, wood, brick, stone, asphalt, building paper, and ordinary non-metallic building materials, in the direction of the least dense vapor area, usually the coldest. When it touches here a substance colder than the dew-point of the air which holds it, vapor condenses.

Condensation stimulates the growth of fungi and insects which greedily break down wood and cause timber rot. It causes paint to peel, plaster to crumble, iron to rust.

HOW TO MINIMIZE CONDENSATION

Almost impervious to vapor, scientific multiple aluminum also retards condensation-formation. The slight mass of the aluminum foil on the warm side (1/5 oz. per sq. ft.) quickly approximates the adjacent air's temperature (by conduction), and so can extract very little heat from the air. Therefore the adjacent air on the warm side remains warm and can retain its vapor content in suspension, avoiding condensation formation. On its colder side, the aluminum foil is slightly warmer than the air adjacent to it. Since heat flow in conduction is from warm to cold, the added warmth enhances the ability of this air to hold more vapor without condensing.

DRASTICALLY RETARDS HEAT FLOW

The aluminum surfaces have a high 97% reflectivity to heat rays; a low 3% emissivity. The foils also reduce inner and outer convection. Conduction is slight through the preponderant, low density air spaces.

The U. S. National Bureau of Standards has prepared a helpful and informative booklet, "Moisture Condensation in Building Walls." Use the coupon and we will send a free copy.

THERMAL VALUES, INFRA TYPE 4S

Up-Heat	**C .105 = 3⅛" non-metallic insulation***
Wall-Heat	**C .068 = 4¾" non-metallic insulation***
Down-Heat	**C .042 = 7⅞" non-metallic insulation***

*Based on limiting values of Fed. Spec. HH-I-521c

Cost installed between wood joists, material and labor, about 8¢ sq. ft.

Type 6 also available

Can be purchased everywhere through your preferred local dealer.

Infra Insulation, Inc., 525 Bway., N.Y.C. Dept. V-11.
Send "Moisture Condensation in Building Walls."

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Firm_____

Address_____

WASHINGTON OVERTONES *(Continued from page 6)*

• SBA received applications for 512 loans totalling $27,713,000 in September; expected 700 in October. Total since the program was started in 1953—8,856 loans for $244,678,429. Of these, 4,188 were business loans for approximately $190,000,000. Others were disaster loans.

As to taxes, although little hope is held out for **across-the-board tax relief,** Small Business is high on the list of those to be considered. President's Cabinet Committee on Small Business suggests, as a start, cutting to 20 percent the present 30 percent rate on the first $25,000 net.

• House Ways and Means Subcommittee on Excise Taxes was to begin consideration on November 26 of a 395-page bill (HR 12298), to **modernize the excise tax schedule.** Seventy-five changes are proposed, including elimination of several "temporary" war-time levies.

• Housing officials now concede that housing starts for the year may not exceed 1,050,000—a total 20 percent below 1955 levels.

• While disappointing to those who have planned for constant increases, the new figure of "a million a year" is being accepted as a realistic forecast for the foreseeable future. The principal postwar shortage of homes has been met; the number of new families formed by marriage each year is now around 750,000, and a **steady demand for new homes** at the present rate is anticipated.

Commerce and Labor Department statisticians still expect a $44 billion total construction figure for 1956, with a possibility that continued good weather may lift the total to the $44.5 billion they predicted earlier this year.

Vibrations touched off in Washington are often heard as overtones by the individuals or businesses they affect. Here are some which will be noted by those in the air-conditioning, heating, ventilating and plumbing industries.

• **Coal Ash Analyzed.** Bureau of Mines has released an analysis of ash from coals mined in 24 states. Entitled "Analysis of Ash From United States Coal" (Bulletin 567), the report is available at 30 cents per copy only from the Superintendent of Documents, Government Printing Office, Washington, D.C.

• **Mexican Gas.** Federal Power Commission has authorized Texas Eastern Transmission Corporation, Shreveport, La., to install pipeline facilities to increase its capacity by 255 million cubic feet of natural gas per day, and to import natural gas from Mexico to supply part of the requirements of the company's U.S. market. Coal interests opposed the application. Project involves 707 miles of pipeline.

• **Smog Control.** U.S. Public Health Service estimates that it will cost industry $2 billion over the next 10 years to clean up the atmosphere. This is double the present rate of spending. Officials estimate that air pollution costs the nation $3 billion a year in laundry bills, inefficient utilization of fuel, depreciated property values, in addition to damage to health.

• **Storm Window Rules.** Proposed trade practice rules for the combination storm window and door industry have been submitted to industry representatives by the Federal Trade Commission. The rules, 22 in number, were proposed to FTC following an industry conference held last April in New York City.

• **Air-Conditioned Buses.** New owners of Washington's transit buses are eyeing the experience of a test of air-conditioned buses in St. Louis. If successful, and if adopted in Washington, the idea could spread rapidly throughout the nation. Washington, mecca for visitors from every state, is frequently the proving ground selected by merchandisers to introduce new products.

• **Banking on the Atom.** Here's proof of how solid the atom has become in Washington thinking. Export-Import Bank has announced readiness to make loans for nuclear power projects abroad on generally the same conditions as those applying to foreign governments and corporation on conventional power systems.

• **Atom Patents.** Fifty-six patents held by the Atom Energy Commission are available to industries interested in developing industrial use of the atom.

1899 Wrought iron pipe was installed in City Hall in 1899. Services: steam returns, soil, waste and vents, and cold water piping 4" and over.

1910 Pennsylvania Station was built in 1910. Wrought iron pipe was installed in steam supply lines, soil, waste, vents, leaders, and cold water lines.

These New York City buildings tell an important story about Wrought Iron Pipe *cost-per-year*

Because *cost-per-year* is the only logical guide to economical pipe selection, service-life records are a vital factor.

What about wrought iron pipe *cost-per-year?* A typical answer is found in the service-life records illustrated by these New York City buildings. The maintenance-free operation provided by wrought iron since installation date is a dependable index to the material's lower cost-per-year of service.

If you are planning a new building, our bulletin, *Piping for Permanence*, will help you with any questions you have about wrought iron pipe, and its ability to save because it serves longer. Write for a copy.

A. M. Byers Company, Pittsburgh, Pa. Established 1864. Boston, New York, Philadelphia, Washington, Atlanta, Chicago, St. Louis, Houston, San Francisco. International Division: New York, N. Y. *Available throughout the world.*

1912 Woolworth Building, 1912 Wrought iron pipe in soil, waste, vents some cold water risers, branch lines, and steam supply, condensate returns.

1931 Irving Trust Company Building was built in 1931. Wrought iron pipe was installed in the steam return lines and all vents.

1913 Municipal Building was built in 1913. Wrought iron pipe installed in steam returns, soil, waste and vents, and cold water piping 4" and over.

BYERS ***Wrought Iron Tubular and Hot Rolled Products***

ALSO ELECTRIC FURNACE QUALITY STEEL PRODUCTS

BRIEFLY STATED

• The **Bituminous Coal Institute,** Washington, D.C., has set up an expanded marketing program for the soft coal industry to encourage the increased use of bituminous coal and to improve the competitive position of bituminous coal in industrial, commercial, domestic and retail markets. M. L. Patton, Cincinnati, vice-president of Truax-Traer Coal Co., has been designated executive vice-president, with Carroll F. Hardy as managing director. Headquarter offices will be at 802 Southern Building, Washington 5, D. C. One of the services of BCI will be to render engineering assistance with a view to promoting the most efficient and economical utilization of bituminous coal. Twelve district offices, staffed by qualified engineers, have been established throughout the coal-consuming areas of the United States.

• Frick Company, Waynesboro, Pa., has opened a new branch office at Palo Alto, Calif., in charge of **Alan J. Vandermade.** It is located at 809 San Antonio Road.

• **Joseph H. Mason** has been appointed to the executive staff, general sales department, Johnson Service Co., Milwaukee. His duties will include supervision of the company's technical recruiting program and liaison work with engineering colleges and technological institutes.

• **Worthington Corp.** announced the acquisition of a West Coast manufacturing plant as a further step in the company's expansion in the year-round home air conditioning field. The plant, acquired from Royal Jet, Inc., is located in Alhambra, Calif., and will be operated as the Western Air Conditioning Division. Its products will include warm air furnaces and air handling equipment for year-round air conditioning systems.

• Iron Fireman Manufacturing Co. has appointed two new branch managers. **Gurth Baldwin,** who joined the company in 1947, has been named manager of the branch in St. Louis, Mo. **Richard H. Byers,** with the company since 1948, was named manager of the Cleveland branch.

• **Carl U. Larson** has been appointed directing engineer of plumbing engineering for Crane Co. He joined Crane 30 years ago. He will direct engineering development of plumbing products.

• **Edmund G. Seergy** has been appointed manager of National Account Sales for Typhoon Air Conditioning Co., Division of Hupp Corp., Brooklyn, N. Y. His activities will involve national account business and will entail contacting engineers, architects and real estate management firms. Mr. Seergy served as Division Manager and Sales Engineer with Frigidaire for eight years, and previously had been associated with Fedders-Quigan and McCray Refrigerator Co.

• **B. L. Binford,** formerly Chief Engineer, has been elected Vice President in Charge of Manufacturing, of Magnetrol, Inc., Chicago.

• **Richard G. Lyall,** who has been serving as chief engineer of Adsco Industries, Inc., has been appointed vice president in charge of engineering. Mr. Lyall worked for Lackawanna Steel Construction Co. from 1930 to 1936, when he became associated with Farrar & Trefts, Inc., and later was vice president in charge of engineering. Farrar & Trefts is now a division of Adsco Industries, Inc.

• **Donald J. Wood** has been appointed General Sales Manager for the Evansville Division of Bendix-Westinghouse Automotive Air Brake Company. He is to be responsible for the marketing of Bendix-Westinghouse compressors and condensing units to the refrigeration and air-conditioning industry. This line will be manufactured in Bendix-Westinghouse newly acquired facilities in Evansville, Ind.

• **Walworth Co.,** has contracted to acquire all the outstanding capital stock of the Grove Valve and Regulator Company, and Grove Controls, Inc., both of Oakland, Calif. The Grove companies have developed controls and ultra-high pressure regulators for the gas and oil producing business, and the chemical and petrochemical industries.

• **Howard M. Cutshaw** is the new general sales manager for Iron Fireman Manufacturing Co. He will direct sales activities of domestic, commercial and industrial heating and power equipment and air conditioning.

• **Robert K. Miller** has been appointed general manager of the General Electric Home Heating and Cooling Department in Tyler, Texas. Prior to this appointment, he was manager of manufacturing for the Vacuum Cleaner Department, Cleveland, Ohio.

• **John T. Obrig** is now eastern regional sales manager for Unarco Air Conditioning Products, National-U. S. Radiator Corp., Johnstown, Pa. Until recently, he had the same position in the Air Conditioning Division of Union Asbestos & Rubber Company, Chicago, which was acquired in July by National-U. S. Radiator Corp.

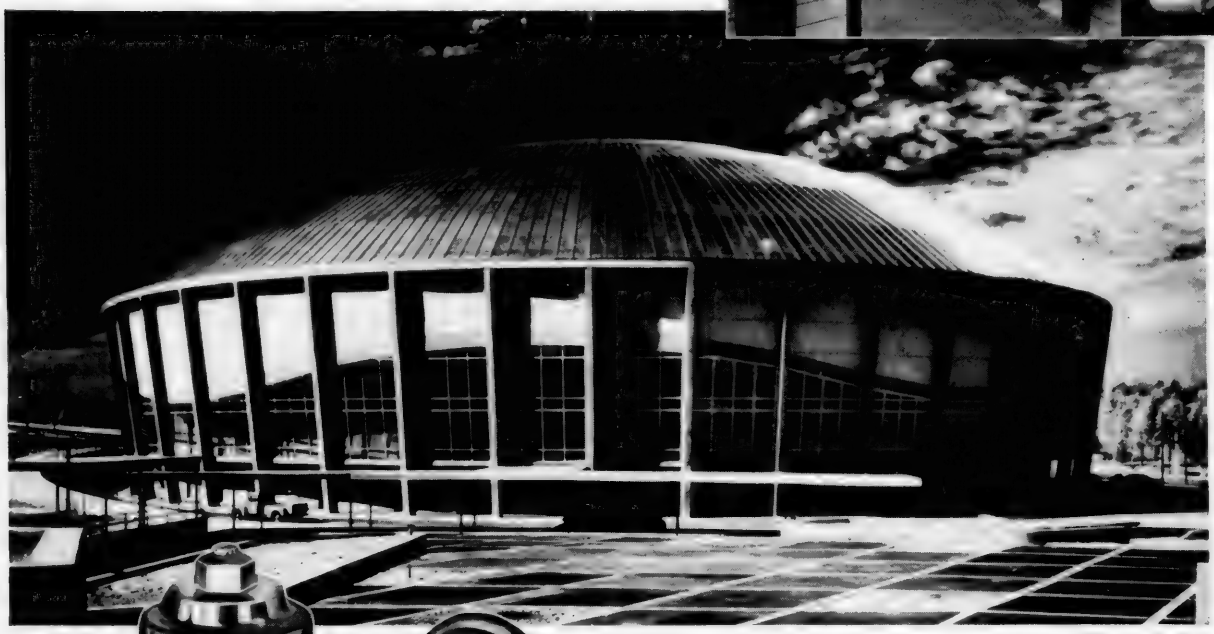
• **Benjamin Linsky,** the president of the Air Pollution Control Association, has been appointed administrative control officer for the new Bay Area air pollution control district in San Francisco. Director of Detroit's air pollution control program since 1951, Mr. Linsky is a member of the faculty of the College of Engineering, Wayne University.

• **John M. Vanselow** is the new field sales representative in the Philadelphia area for L.O.F. Glass Fibers Company, Toledo, Ohio. Previously he was an assistant in the Customer Service Department of the company.

(*Continued on page* 12)

And in Charlotte — A FUTURE OF FAULTLESS SERVICE

AUDITORIUM AND COLISEUM
Charlotte, North Carolina
A. G. ODELL, JR. A.I.A.
architect
W. P. WELLS
mechanical engineer
P. C. GODFREY, INC.
plumbing contractor
ATLAS SUPPLY COMPANY
wholesale distributor
KOHLER CO.
plumbing fixtures manufacturer



Alderman Studios

Civic pride gets a four and one half million dollar boost with the completion of the breathtaking Charlotte Auditorium and Coliseum . . . fully equipped with COYNE & DELANY flush valves. Included are a finely detailed auditorium (not shown) for 2500 theatre or concert lovers and a separate coliseum seating 13,500 for athletic events, circuses, and ice shows. Over one million persons within an hour's driving time will benefit by the 23 acre complex. Here, as in so many fine projects in the Carolinas, DELANY diaphragm type flush valves . . . several hundred in all . . . will complement interior appearances and serve the cause of freedom from maintenance. Where standards are high, where expected usage is great, look for DELANY — "the fastest growing name in flush valves!"

This new "HAND BOOK and CATALOG No. 53" is the most comprehensive of its kind—designed for everyday reference . . . 19 pages of installation details for exposed, concealed and special FLUSH VALVE installations . . . over 75 blue prints . . . cut away views . . . many pages of charts, formulae, piping details . . . sent free, if requested on firm letterhead.

COYNE & DELANY CO. • 834 KENT AVE. • BROOKLYN, NEW YORK
IN CANADA: THE JAMES ROBERTSON CO., LTD.

DELANY *Flush* **VALVES** Since 1879

BRIEFLY STATED

(*Continued from page* 10)

• **Milo Harrison Buzzee,** industrial designer and research engineer, has joined Tube Turns Plastics, Inc., Louisville, Ky. He will direct the marketing of custom molded products and handle special assignments. From 1951 until his present appointment he was sales manager for the plastics department of Jackson & Church Company, Saginaw, Mich.

• **L. P. Jenkins** has been appointed marketing manager of Richmond Plumbing Fixtures Division, Rheem Mfg. Co., Metuchen, N. J. He will be responsible for developing sales campaigns with wholesale distributors and the plumbing trade.

• **Herbert G. Stephan** has been named Supervisor of Execution Engineers, a new post, by Airtemp Construction Corp., Dayton, Ohio. He will, on major air conditioning contracts, coordinate the work of subcontractors and oversee job progress. His new position follows a sixteen-year association with McCrory Stores, Inc. With the McCrory chain he was connected with new store construction and held the post of Construction Superintendent.

• Six branch office appointments are announced by the Powers Regulator Co.

Named to new posts are: **L. A. Wehrheim** to branch manager, Wichita, Kans., office; **R. E. Stephens,** as textile specialist, Greensboro, N. C., office; **Nathan H. Keller** to sales engineer, Dayton, O., office; **Nicholas Kies** to sales engineer, Milwaukee office; **Robert L. Kiely** to sales engineer, Philadelphia office; **Harry F. Kohaut** to sales engineer, New York office.

• **Everett P. Palmatier,** formerly director of research, has been named manager of the Transportation Equipment Dept., Carrier Corp.

He will supervise development, manufacture and sale of aircraft air conditioning and railroad, bus and truck trailer air conditioning and refrigeration.

Succeeding Mr. Palmatier as director of research is Dr. Dewey J. Sandell.

• **John G. Reid** has been named engineering manager, Absorption Systems, York Corp., a subsidiary of Borg-Warner Corp. He comes from the Crosley and Bendix Home Appliances Div., Avco Mfg. Corp. At Avco, he was manager of air conditioning engineering for five years following eleven years as mechanical research engineer on absorption systems at Servel, Inc.

• **Edward H. Leimbacher** has been appointed assistant to the president of Welding Fittings Corp., New Castle, Pa.

• **J. Edwin Aspinall Co.** is now representing Pacific Steel Boiler Div., National-U.S. Radiator Corp., through its main office in Indianapolis and from a branch office in Fort Wayne that is headed by Thomas Haffner.

• **Pugh Heating & Air Conditioning Co.,** Toledo, Ohio, has been named area distributor for Airtemp commercial air conditioning equipment and home air conditioning systems.

• **R. S. Martin** has joined the Airtemp Division, Chrysler Corp., as district manager, West Coast Region.

• Continued growth of Minneapolis-Honeywell Regulator Company's domestic temperature-control business has led to a consolidation of the firm's sales administration in this field. The present Heating Controls Division of Minneapolis-Honeywell Regulator Co. will be known as the Residential Division. It will have responsibility for the sale of all types of temperature control equipment for homes, including Electronic Moduflow. This division will be directed by **K. L. Wilson,** vice president.

• **T. A. Crawford** has joined York-Shipley, Inc., York, Pa., as director of marketing. He was with Timken Silent Automatic for more than 30 years and served as vice-president and general manager for 13 years.

• **Skuttle Manufacturing Co.** has acquired controlling interest in **Hadley Products Co.,** Marietta, Ohio. This is the first in a series of moves contemplated by Skuttle to provide diversification of its present humidification equipment to encompass a complete line of heating and air conditioning accessories.

• **G. W. Kelch** was named president of Borg-Warner Corp's. recently acquired Ingersoll-Humphryes Division, at Mansfield, Ohio. He was previously executive vice president of the division.

• Young Radiator Company, Racine, Wis., has named **Paul E. Evans** as Eastern District sales supervisor for its Heating, Cooling and Air Conditioning Division. His headquarters will be in the New York metropolitan area.

• Appointment of a general sales manager and two internal executive shifts was announced by the Brunner Mfg. Co., Utica, N. Y. **Wallace J. Hoeing,** former sales manager of the air conditioning division of Servel, Inc., has been named sales manager to head the overall sales organization of the local company and its Gainesville, Ga., subsidiary, The Brunner Co. **A. G. Zumbrun, Jr.,** formerly at the Gainesville plant is now supervisor of sales, Utica refrigeration. **Paul A. Hunker,** formerly in Utica, has been moved to Gainesville as supervisor of sales, Hermetic Division and transferred to Gainesville.

• **Dick Cotton** has been appointed by Hoffman Specialty Mfg. Corp., Indianapolis, Ind., as sales representative for Minnesota, North Dakota, part of South Dakota and the western part of Wisconsin.

• **R.C.S. Tool Corporation** moved on November 1 to 227-229 East Front St., P.O. Box 661, Bloomington, Ill.

AEROFIN

Heat-Transfer Surface

Aerofin is sold only by manufacturers of nationally advertised fan system apparatus. List on request.

● High Efficiency

● Long Service Life

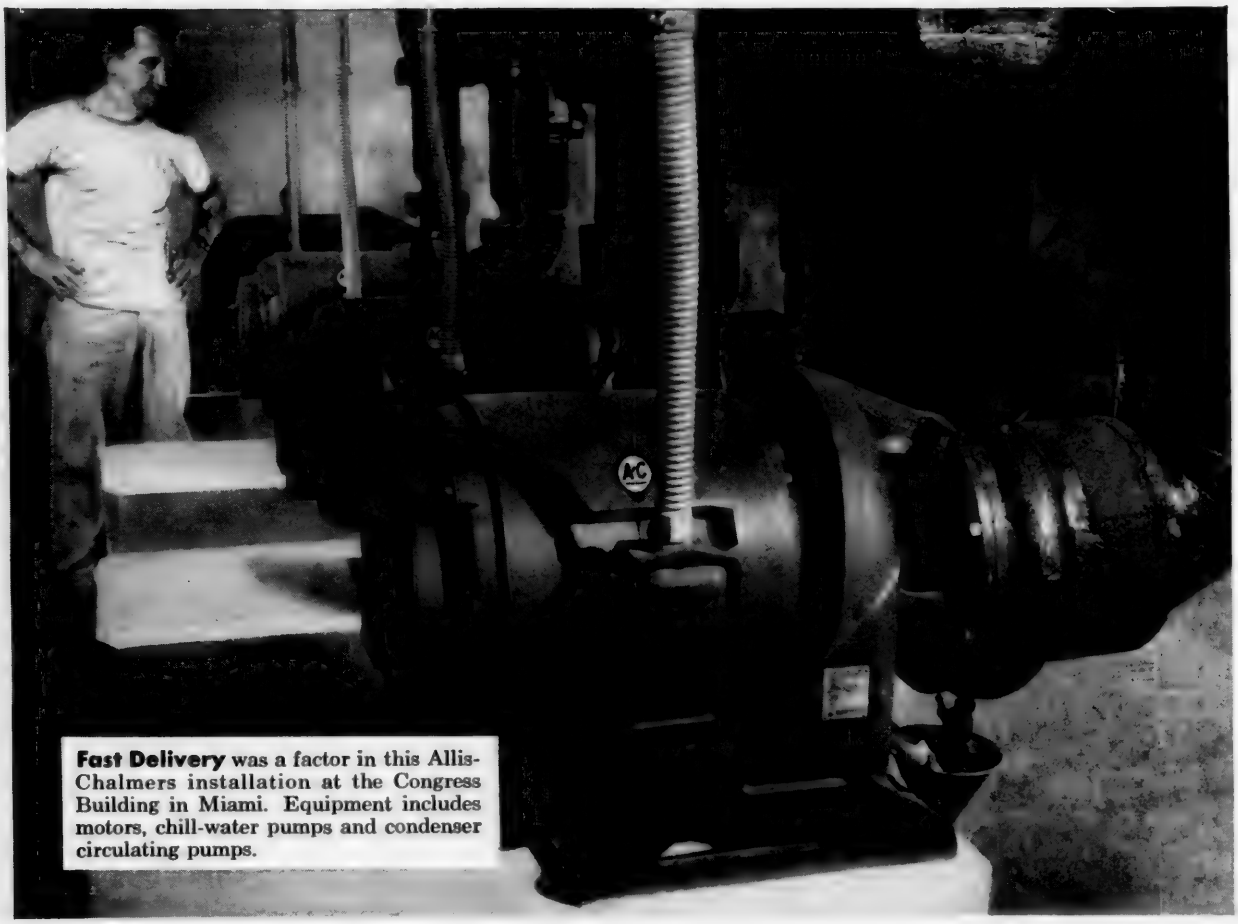
● Low Maintenance Costs

You are assured of high efficiency in heating or cooling—long service life—low maintenance and service costs, when you specify Aerofin extended-surface heat exchangers.

The reason is obvious: Aerofin makes heat exchangers *exclusively*—offers you the results of unequalled experience, unequalled production facilities, unequalled materials testing and design research—and the guidance of a complete, highly skilled engineering staff, at the plant and in the field.

For the most practical solution to your heat-exchange problem, ASK THE AEROFIN MAN.

AEROFIN CORPORATION
101 Greenway Ave.
SYRACUSE 3, N. Y.



Fast Delivery was a factor in this Allis-Chalmers installation at the Congress Building in Miami. Equipment includes motors, chill-water pumps and condenser circulating pumps.

For quick delivery on motors and pumps

Specify Allis-Chalmers

WHEN you specify equipment for air conditioning installations, you want *dependability* and delivery *when you need it*. Allis-Chalmers guarantees you both with its complete line of motors and pumps.

Local Stock

A national network of authorized distributors, plus strategically located warehouse stocks, assures you *prompt* delivery of the right equipment for your job. Whatever your location, Allis-Chalmers makes sure that your installation won't be slowed down by poor delivery or "broken shipping promises".

More Dependable Cooling

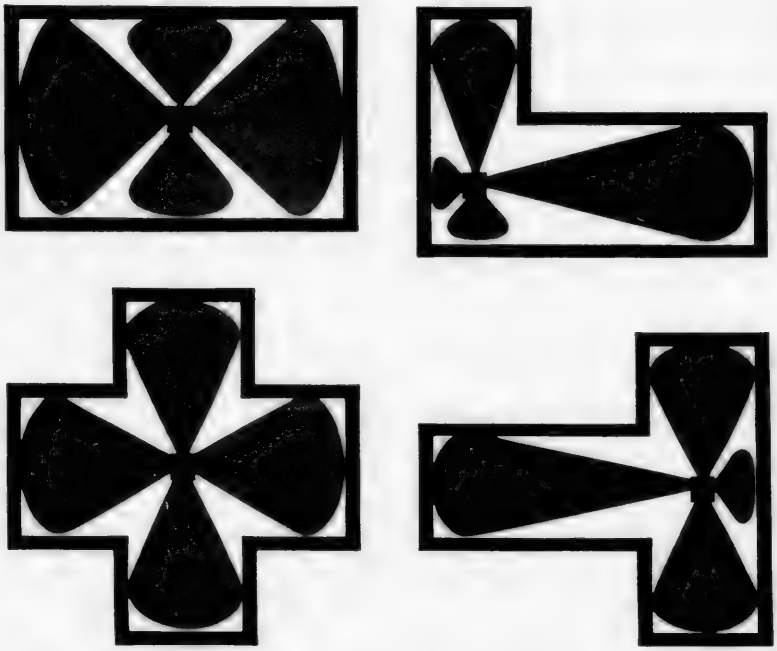
Once you install Allis-Chalmers, your system has equipment known for its ability to keep going season after season. Unit responsibility means A-C pumps and motors are engineered to work together. Your customers are assured of staying cool and you slash service call-backs.

Along with Motors and Pumps, A-C supplies control and V-belt drives. You can obtain the name of your distributor by contacting your nearby Allis-Chalmers sales office, or write Allis-Chalmers, General Products Division,
Milwaukee 1, Wisconsin.

ALLIS-CHALMERS

A-5188

Carrier "Clover Leaf" heating coverage adjusts to any floor plan

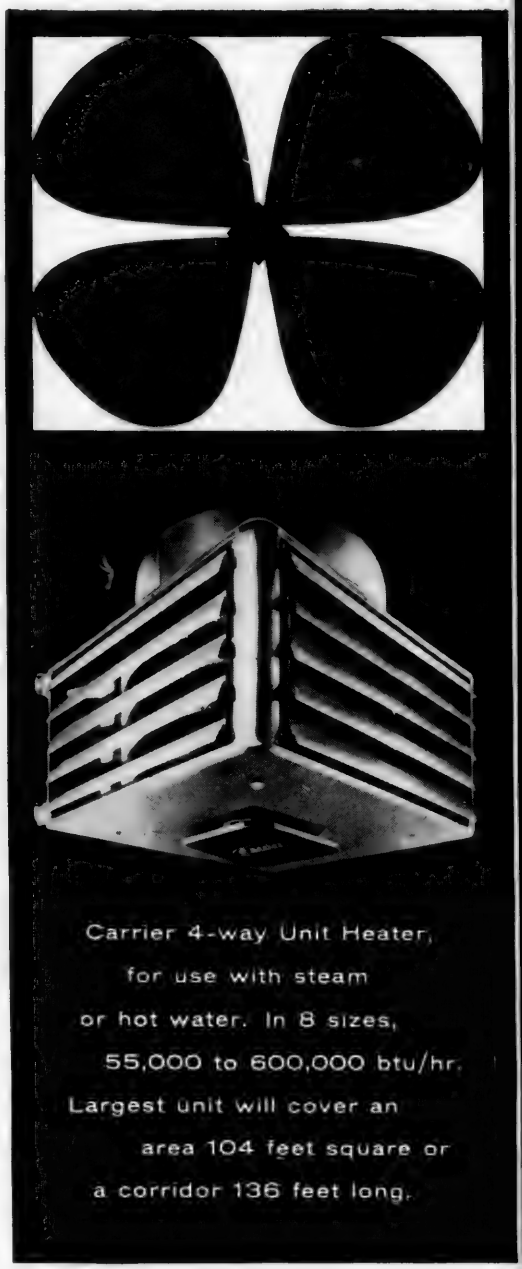


Why use 2 or more old-style unit heaters when one modern Carrier "Clover Leaf" unit can do the same job?

The "Clover Leaf" has 4 discharge outlets that can be individually adjusted to heat square, L-shaped, T-shaped and I-shaped areas. It can discharge air in 2, 3 or 4 directions at one time. For instance, using all 4 outlets the "Clover Leaf" can heat a room up to 104 feet square. Or using only 2 outlets it can heat a corridor 136 feet long. All these variations in heating coverage require no change in outlets, no extra accessories!

"Clover Leaf" gives you this extra heating coverage and versatility at a total cost below what you pay for ordinary heaters—because you need fewer "Clover Leaf" units to do a job. You save your clients money on first cost, installation, operating and maintenance costs. They're money ahead when you specify Carrier "Clover Leaf" Unit Heaters!

For your copy of a new 8-page catalog which tells about the "Clover Leaf" unit in detail, call your Carrier manufacturer's agent. He's listed in the Classified Telephone Book under "Heaters—Unit." Or write Carrier Corporation, Department UH, Syracuse, New York.

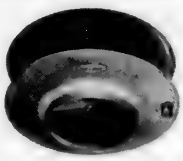


Carrier 4-way Unit Heater, for use with steam or hot water. In 8 sizes, 55,000 to 600,000 btu/hr. Largest unit will cover an area 104 feet square or a corridor 136 feet long.

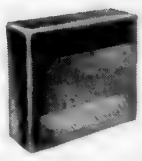
industrial heating
air conditioning
refrigeration

Carrier

Horizontal Unit Heaters

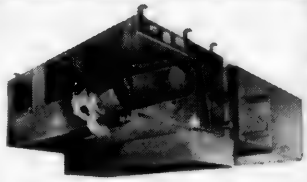


Vertical Unit Heaters

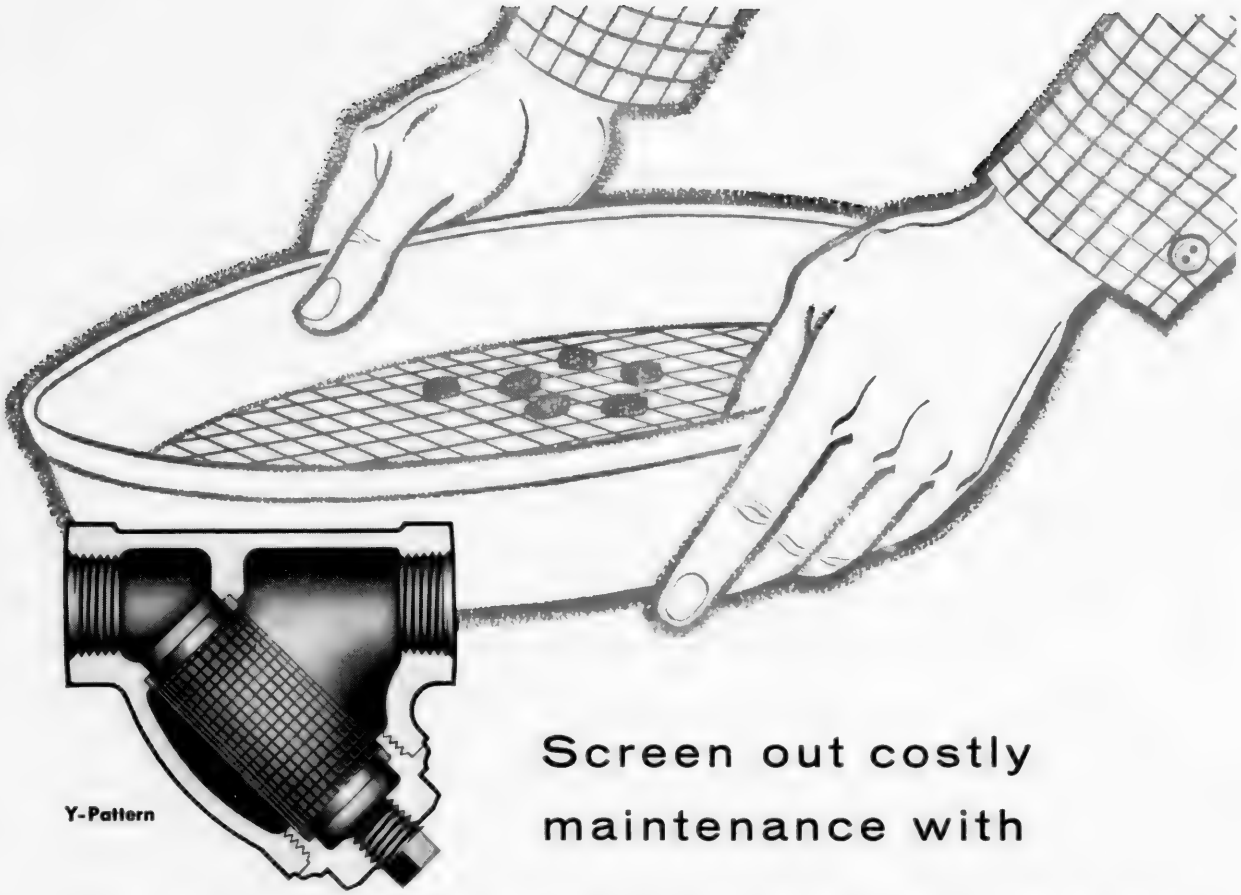


Cabinet Unit Heaters

Gas-fired Unit Heaters



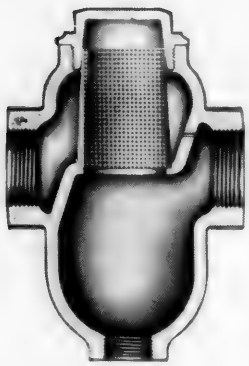
Heating and Ventilating Units



Y-Pattern

Screen out costly maintenance with

CRANE SEDIMENT SEPARATORS



Vertical Types

Crane Sediment Separators positively and automatically trap foreign matter in fluid-handling lines—steam, water, air, oil or gas, high or low pressure—and hold it for easy removal.

Dirt, scale, sand and other injurious particles are prevented from damaging or spoiling product and ruining valve seats, automatic devices and other delicate equipment.

Because of their exceptionally large screening areas—more than 500% greater than pipe area—Crane Sediment Separators assure unrestricted flow of product, even when partially plugged. Note special blow-off connection for drain valve attachment which permits easy cleanout without interrupting flow service.

LITERATURE SENT ON REQUEST

Available in both Y-patterns and vertical types, with full range of capacities and sizes. For literature on Crane Sediment Separators, see your Crane Representative or write to address below.

CRANE VALVES & FITTINGS

PIPE • KITCHENS • PLUMBING • HEATING

Since 1855—Crane Co., General Offices: Chicago 5, Ill. Branches and Wholesalers Serving All Areas

a bold new concept . . .

Honeywell brings Advanced Automation to Air Conditioning with the

SUPERVISORY DataCenter

Each Supervisory DataCenter is custom-made by Honeywell to engineers' and architects' specifications. Here is a typical DataCenter showing the functions of the various panels.

(1) **Typical Central Supply Unit.** Provides remote adjustment of mixed air and coil deck temperatures, plus coil air temperature readings. Final space temperature is determined by local pneumatic thermostats that regulate the percentage of air passing through the coil deck bypass for each zone. (These temperature readings —as well as those concerned with other panel functions in the complete system —are shown by the indicator located on the vertical top center panel.)

(2) **Typical Annex Unit.** These units control space temperatures in other areas of the building. Temperature corrections are made by means of the control point adjustment knobs located beneath the graphic outline of the building.

(3) **Interior Space Temperatures.** Outline provides graphic floor-by-floor picture of the interior space thermostats. Push-button control and adjustment may be made from the panel.

(4) **6-Point Temperature Recorder.** To permit careful analysis of operations, this instrument gives a simultaneous record of any 6 temperature pickups in the entire system.

(5) **Basic Heating and Cooling Circuit.** Start-stop buttons control circulating pumps; pilot lights indicate which equipment is operating. Panel also provides several push-button temperature readings with adjustment of controlling thermostats.

(6) **Primary Air System.** This section provides push-button temperature readings, and adjustment of thermostats controlling reheat and dehumidifier coils.

(7) **Basic Refrigeration Plant Supervision.** Shown here is color diagram of the system with miniature controller for remote indication and adjustment of chilled water temperature. Accessory equipment can be started and stopped at the panel—pilot lights indicate when they're running. Push buttons provide temperature readings at all key points in this system.

One man operation of a complete year-round climate control system saves thousands of dollars for building owners

Focuses all eyes on air conditioning. Publicly displayed, a colorful Honeywell Supervisory DataCenter does a lot to highlight a building's "hidden" deluxe comfort features.

ADVANCED automation in air conditioning, made possible by the Honeywell Supervisory DataCenter, has resulted in many remarkable achievements in practically every phase of indoor climate control.

New techniques of automation, instrumentation and electronics make air conditioning as automatic as possible and provide for efficient supervision.

Operating efficiencies have been realized that were never believed possible. To the public it has brought a new standard of comfort. And to the engineer and architect it offers the opportunity to dramatize the use of air conditioning and provide flexibility of design that will avoid obsolescence for years to come.

And remember, every component in a Honeywell Supervisory DataCenter is made by Honeywell, backed by Honeywell's dependable service.

Central control of every floor. Temperature in open areas on every floor, plus functions in the complete system are always under finger-tip control at one central point.

Better individual room thermostat control. A DataCenter improves space thermostat performance by permitting closer supervision of the primary heating and cooling supply.

DataCenter does the "leg work." Readings from any remote point in the building come to one central control panel—eliminating the need for laborious, manual floor-by-floor checking.

Savings liquidate equipment cost. A DataCenter combines a number of operating maintenance jobs into *one*—also detects operating irregularities to make trouble shooting easier, faster.

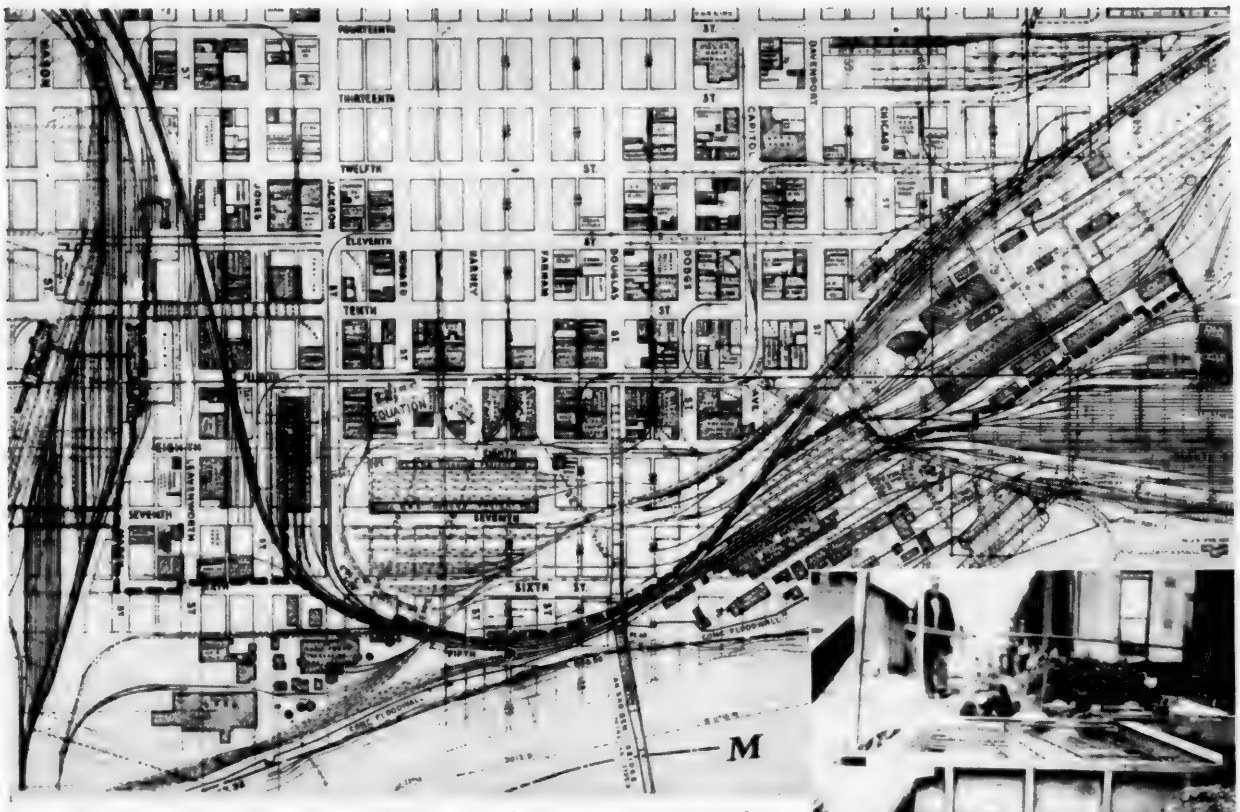
For skyscraper, super market—for any size building, because each supervisory DataCenter is custom-made with the controls and instrumentation to fit a specific air conditioning system.

SUPERVISORY DataCenter

For further information about the Supervisory DataCenter, call your Honeywell office, or write: Honeywell, Dept. SDC-3, Minneapolis 8, Minnesota

A product of MINNEAPOLIS Honeywell

First in Controls



Union Pacific installation (heavy dotted line) runs under pavement to various shops and buildings. Gilsulate has high load-bearing capacity, takes heavy pounding here.

9250 ft. of GILSULATE®-covered steam lines help Union Pacific run smoothly in Omaha

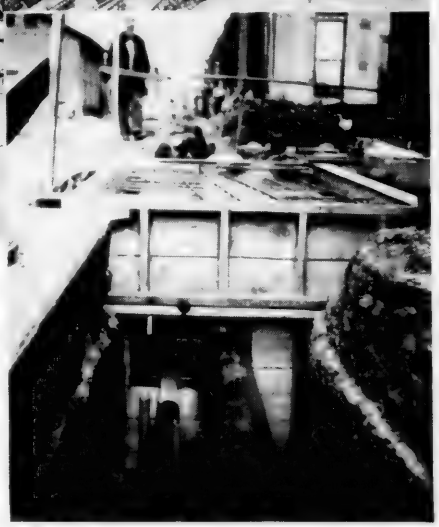
Under tracks, alongside of tracks, under heavily-trafficked streets—practically all types of tough in-service conditions have been overcome by GILSULATE at Union Pacific Railroad's Omaha installation. Running from the main boiler room of the UP shops to the Union Station, the distribution system consists of three sections: 1) a 2800-foot section of 8-inch steam line; 2) 5300 feet of 8-inch steam and a 4-inch diesel oil line; 3) 1150 feet of 3-inch steam line branching from section (2) and carrying 150 psi steam plus 100 degrees superheat.

First installed in 1954 and continually subjected to pounding, shock and vibration from heavily-loaded freight trains and normal yard traffic, this GILSULATE system has functioned flawlessly. 810 tons of Type C GILSULATE were used initially, and additional installations are being made here and at other Union Pacific yards.

GILSULATE's insulating efficiency, all-around pipe protection, and high loading capacity make it the ideal choice for this and other types of installations. More and more, architects, engineers and contractors are discovering that GILSULATE provides permanent corrosion protection for hot underground pipes at the lowest cost per installed linear foot of any other pipe insulation system.

Investigate the value of low-cost, easily-installed, dependable GILSULATE. See your local GILSULATE distributor for a convincing demonstration. Complete details are yours for the asking. Write the office nearest you.

AMERICAN GILSONITE COMPANY
SALT LAKE CITY 1, UTAH
Affiliate of Barber Oil Corp. & Standard Oil Co. of Cal. OFFICES at: 134-A West Broadway, Salt Lake City, Utah; 1145 East Jersey Street, Elizabeth 4, New Jersey; The Agents Building, 3537 Lee Road, Cleveland 20, O.



An 8-inch steam and 4-inch diesel line entering a bellows-type expansion joint in a manhole; system was installed by UP crews.

FACTS ABOUT GILSULATE

1. **EASY TO USE**—just pour and tamp...pipe heat does the rest.
2. **FORMS 3 ZONES** of protection against heat loss and all hazards commonly encountered by hot buried pipes.
3. **NEEDS NO HOUSING OR MECHANICAL SHEATHS:** no mixing, special handling or equipment.
4. **ONLY NEEDS NORMAL PIPE SPACING:** for multiple pipe or cramped conditions.
5. **THREE TYPES AVAILABLE:**
   Type A for 220°-300°F. temp. range
   Type B for 300°-385°F. temp. range
   Type C for 385°-520°F. temp. range

GILSULATE®
The Triple-Zone Insulation System For Lifetime Protection of Hot Underground Pipes

Leak-free joints made easily with torch and solder.

Section of system ready for paving.

Milwaukee Gas Light Company

MAKES SNOW GO

with Chase Copper Water Tube!

Blizzard snows and freezing rain don't stand a chance around 626 East Wisconsin, in Milwaukee! The Milwaukee Gas Light Company's sidewalks are always free of snow and ice—thanks to an efficient snow removal system of Chase copper tube!

The contractor, John S. Jung, used both Chase Type L copper tube and Chase copper solder-joint fittings in the installation. This combination is unsurpassed for easy, fast installation plus trouble-free performance over the years! You see, corrosion-resistant Chase copper tube comes in long lengths that are easily bent into position and require fewer joints. Tube and fittings are *made for each other,* so leakproof solder-joints are assured. They expand and contract *as one unit* with temperature changes!

Snow everywhere . . . but not around Milwaukee Gas Light Co. building!

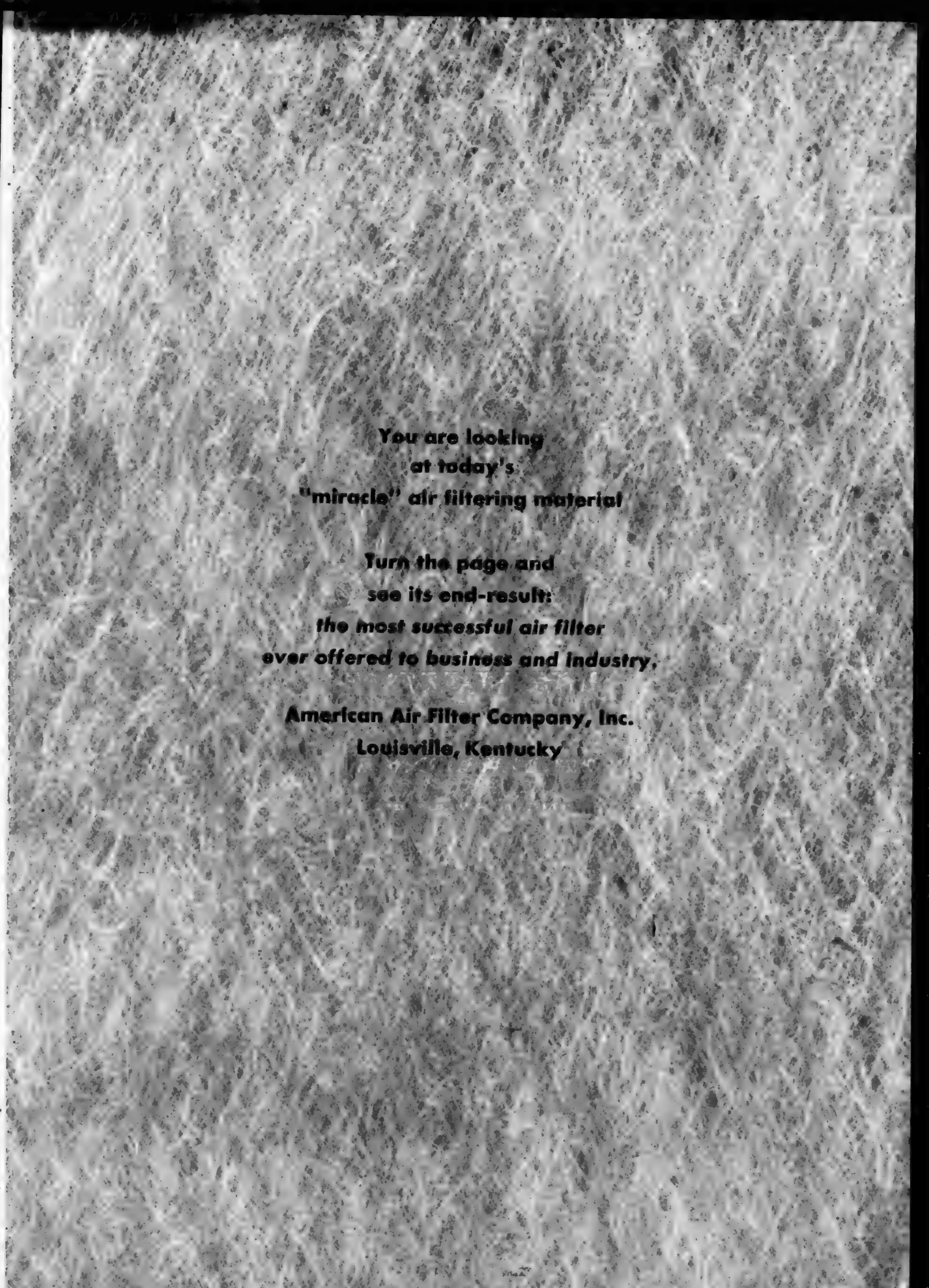
Chase®

BRASS & COPPER CO.

WATERBURY 20, CONNECTICUT • SUBSIDIARY OF KENNECOTT COPPER CORPORATION

The Nation's Headquarters for Brass, Copper & Stainless Steel

Atlanta, Baltimore, Boston, Charlotte, Chicago, Cincinnati, Cleveland, Dallas, Denver, Detroit, Grand Rapids, Houston, Indianapolis, Kansas City, Mo., Los Angeles, Milwaukee, Minneapolis, Newark, New Orleans, New York, Philadelphia, Pittsburgh, Providence, Rochester, St. Louis, San Francisco, Seattle, Waterbury


You are looking
at today's
"miracle" air filtering material
Turn the page and
see its end-result:
the most successful air filter
ever offered to business and industry.
American Air Filter Company, Inc.
Louisville, Kentucky

The one-and-only AAF Roll-O-MATIC

MAINTENANCE: **Maintenance as simple as changing film in your camera**

OPERATION: **Operation is completely automatic**

COST: **Cost of operation just half that of disposable filters**

No other product in the history of air filtration has ever received the immediate acceptance, gained the overwhelming preference of AAF's amazing Roll-O-Matic. Here are some of the reasons why it has emerged in just a few short years as America's most *successful* filter:

"MIRACLE" MEDIA. Exclusive Roll-O-Mat media offers the dust-holding capacity of a viscous filter, *yet handles like dry-type media.* And a 65 ft. length of this fluffy blanket of bonded glass fibers compresses to paper-like thinness . . . measures only 13" in diameter on the roll. Specially-developed AAF viscosine (for precharging media) retains its jelly-like consistency under an unusually wide range of temperature and humidity conditions.

AUTOMATIC PERFORMANCE. There are no dust disposal problems with Roll-O-Matic. They're rolled away as the automatically renewing media moves down the face of the filter. Maintenance involves simply replacing the soiled media roll with a new one, and most users have found that even this simple act is required only *once a year!*

LOW-COST OPERATION. Renewable Roll-O-Mat media is inexpensive, too. Under normal conditions, operating cost of the Roll-O-Matic is just *half* that of disposable filters. Call your local AAF representative for details, or write for Bulletin 248A.

CLEAN AIR BY THE ROLL! Man points to clean media being automatically introduced by the Roll-O-Matic in the Clark Equipment Company plant in Benton Harbor, Michigan. Architects and engineers: The Austin Company.

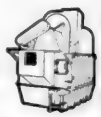
AIR FILTER!

SUPER-CLEAN AIR! Roll-O-Matic filters are used in combination with AAF's Electro-Cell precipitators to supply 158,000 cfm of super-clean ventilation air for the new Lutheran Brotherhood Building, Minneapolis, Minnesota. Architects: Perkins & Will; Engineer: E. R. Gritschke.

AAF herman nelson

American Air Filter
COMPANY, INC.
294 Central Avenue, Louisville 8, Kentucky
American Air Filter of Canada, Ltd., Montreal, P. Q.

AAF Dust Control Equipment

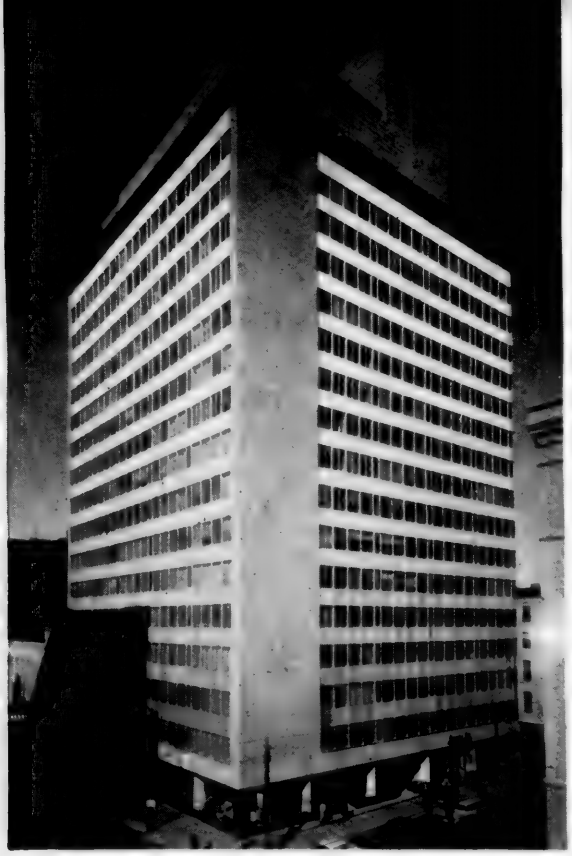


Illinois Heating Specialties

— BETTER AIR IS OUR BUSINESS —

Herman Nelson Unit Heaters

Herman Nelson Unit Ventilators



In America's Leading Buildings, Temperature Control Problems are

PRE-SOLVED by JOHNSON

The new 23-story Denver Club Building* is another impressive example of the exceptional comfort, convenience and economy values of Johnson-engineered Automatic Temperature Control Systems.

The first 16 floors of this modern building are devoted to tenant offices, with each floor providing some 20,000 square feet of rental space. The exclusive Denver Club occupies the upper floors, except for a penthouse apartment.

Mechanical equipment includes a 498-unit Carrier Conduit Weathermaster System, serving the perimeter offices on rental floors, and 20 central fan systems serving the core areas, stores, basement and first floors, club and penthouse areas.

Johnson Control directs all of these systems to produce satisfying, perfectly regulated temperatures throughout the entire building. Operation of all heating, cooling and ventilating equipment is coordinated to limit output to actual needs. Heating and cooling waste is eliminated.

In designing this control system, Johnson engineers *anticipated, and correctly solved,* a wide variety of control problems—problems ranging from the size of the building and the large number of systems to be controlled to the many different exposure, occupancy and usage factors involved. Thanks to this type of expert advance planning, the control system in the Denver Club Building has consistently performed up to expectations—*and from the very beginning!*

Similarly, the specialist Johnson organization can provide an equally successful control system for *any* building. Johnson engineers have pre-solved the temperature regulation problems and installed the automatic control systems for most of the nation's leading buildings, of all types and sizes.

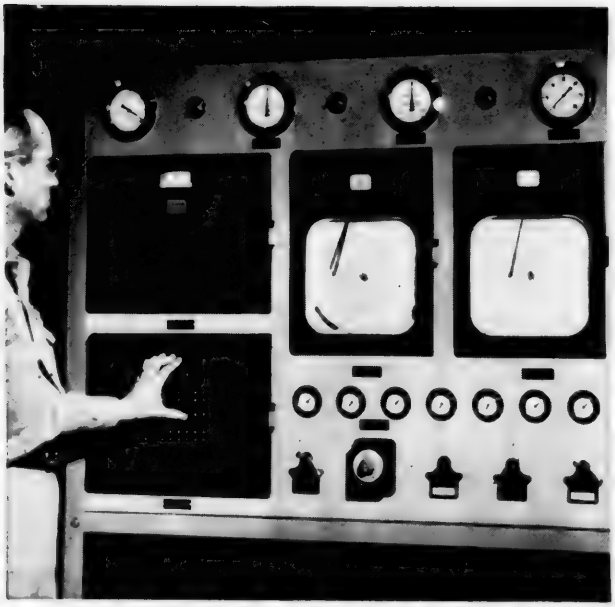
An engineer from a nearby Johnson branch is ready to put this unmatched experience at your disposal. His recommendations are yours without obligation. Johnson Service Company, Milwaukee 1, Wisconsin. Direct Branch Offices in Principal Cities.

*The Denver Club Building, Denver. Raymond Harry Ervin, architect; Marshall and Johnson, mechanical engineers; Denver Plumbing & Heating Co., mechanical contractor; all of Denver.

JOHNSON CONTROL

SINCE 1885

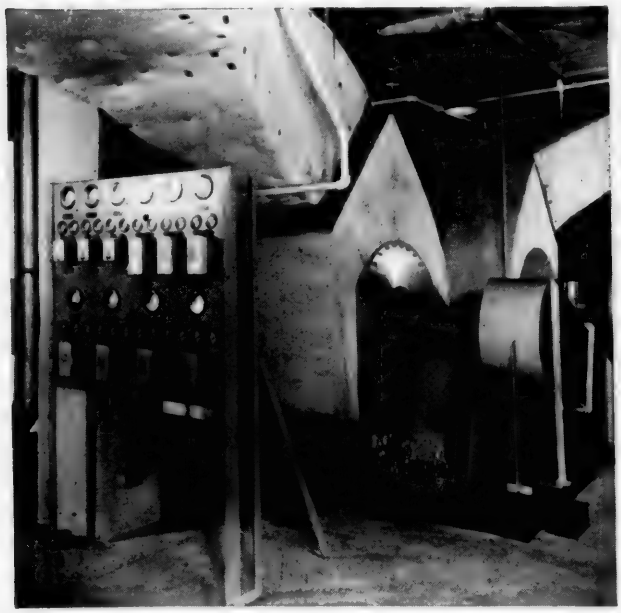
PLANNING • MANUFACTURING • INSTALLING



CONTROL CENTER. From this central control panel a 60-point remote temperature indicator provides an instant check of temperatures at strategic points throughout the systems and in the building. An outdoor temperature recorder, chilled water recorder-controller and summer-winter and heating-cooling changeover switches are also grouped on this panel in the engineer's office.

ROOM CONTROL. Underwindow air conditioning units in perimeter offices are individually controlled by Johnson T-271 Heating-Cooling Thermostats operating V-152 Water Valves on the heating and cooling coils. Tenants enjoy complete comfort as occupants of each office select their own personal "weather." Interior spaces are controlled by strategically located T-400 Room Thermostats.

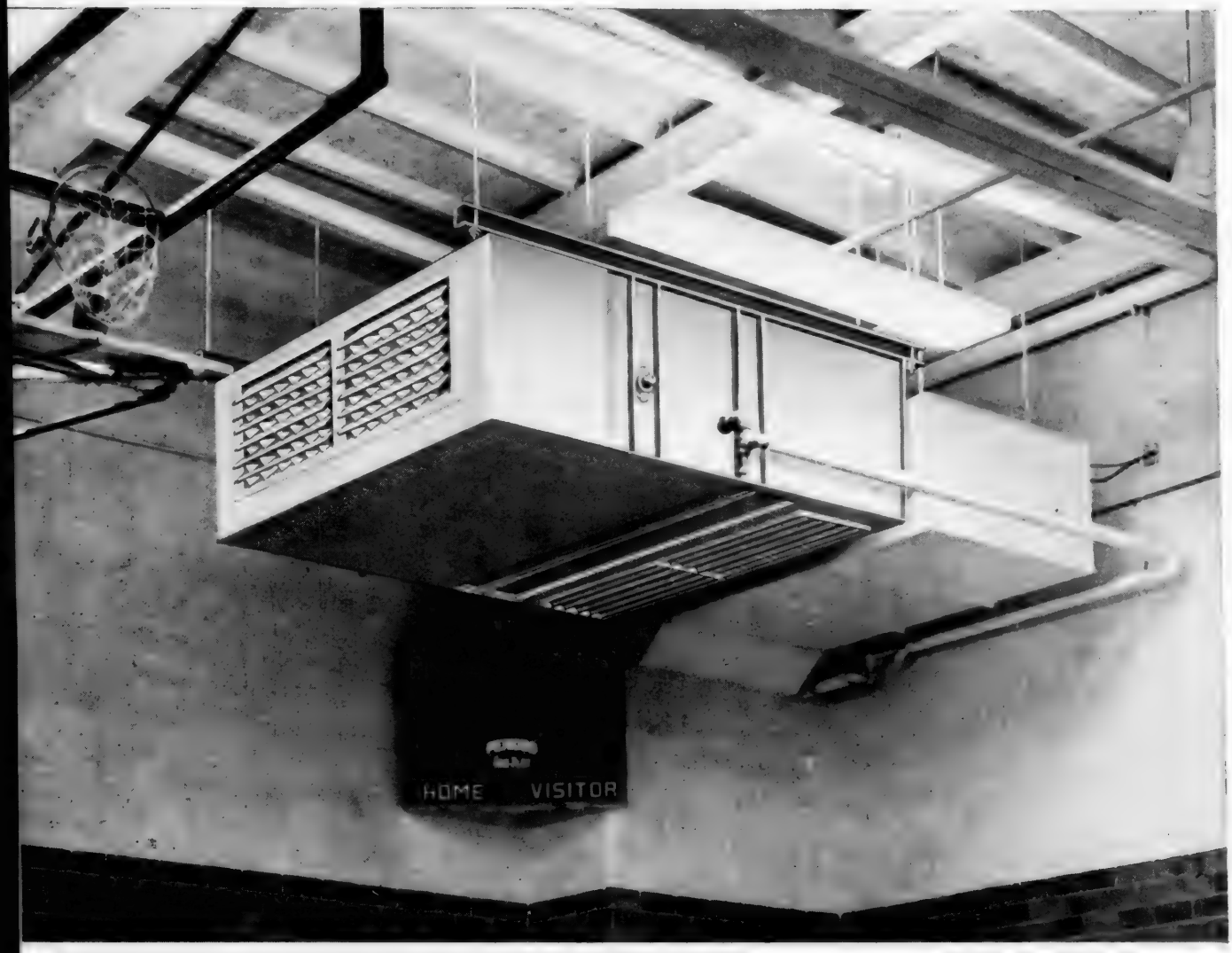
New Denver Club Building Gets the Benefits of Ideal Temperatures, Waste-Free Heating and Cooling Operation



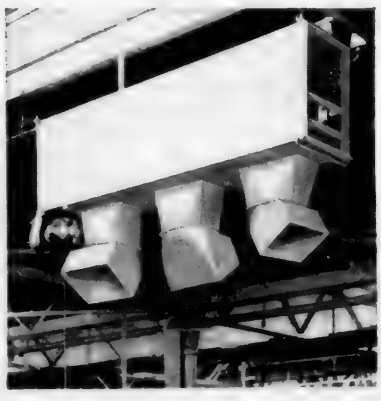
PRE-CONDITIONED AIR. Primary air for room air conditioning units is supplied by central air handling systems. Panel mounted Johnson controllers operate Valves and Damper Operators on the systems to maintain proper temperature and humidity of primary air. Temperatures of the hot and chilled water supplied to room units are kept in balance with outdoor temperatures by other Johnson controllers.

CLUB ROOMS. Year 'round comfort on the three upper floors, occupied by the Denver Club, is provided by sensitive Johnson Thermostats controlling six zones of air conditioning, general ventilation and baseboard radiation systems. During the heating season only the *occupied* rooms need be heated to ideal comfort levels. Rooms not in use may be maintained at low, economy temperatures.

Trane announces the of all purpose heating-



HEAT AND VENTILATE locker rooms, gymnasiums and pools. Torrivent provides a compact unit for any hard-to-heat area—and provides necessary ventilation, too. Torrivents are economical—are turned on only when the space is being used. TRANE high efficiency Fans and Coils assure fast warm-up, maximum velocity. All fans and coils used in the Torrivent are manufactured by TRANE.



HEAT AND VENTILATE large industrial areas. Torrivent delivers a large volume of air heated to uniform temperatures, at uniform velocities. Air stream travels long distances before diffusing or mixing completely with surrounding air. May be used with duct work to heat and ventilate separate rooms or areas. TRANE Torrivents are also ideal for all kinds of industrial process drying and curing applications.

Torrivent...a new line ventilating units...

Now! For every institutional, commercial and industrial job, whisper-quiet, de luxe centrifugal units

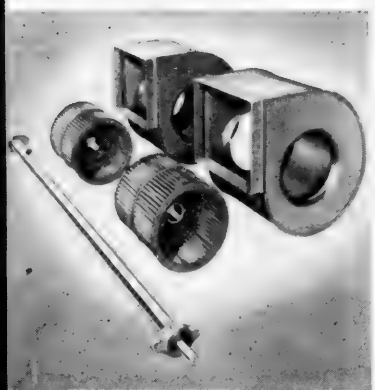
Here's the newest, most versatile heating-ventilating unit in the complete TRANE line! It's the TRANE Torrivent . . . designed to furnish large capacity heating—*and ventilating*—for all types of commercial, institutional and industrial buildings.

The Torrivent handles up to 33,000 cfm of air at low outlet velocities, with low horsepower requirements. And there's a complete range of sizes and models to fit any heating-ventilating job. Use the new Torrivent with or without ducts; install it on the floor, ceiling or wall—anywhere you need a powerful, dependable supply of warm, filtered, humidified and tempered air for heating, ventilating or process.

Ask your nearby TRANE Sales Office for complete facts on the new Torrivent. Or write TRANE, La Crosse, Wis.

CHECK THESE TORRIVENT FEATURES:

- **QUIETER OPERATION**—New, high-efficiency TRANE Fans have low outlet velocities for smooth, quiet operation.
- **MORE VERSATILE**—Torrivent units heat, filter, clean any combination of recirculated and outside air to meet heating-ventilating requirements for commercial, institutional and industrial buildings of every size and type. Also provide an economical, efficient source of heat for process drying, curing and other industrial applications. May be installed with or without duct work on floor, wall or ceiling. Swivel nozzles permit an infinite number of discharge directions.
- **MORE FLEXIBLE**—Complete range of coil types and sizes plus wide choice of filter box, mixing box, plenum and nozzle combinations to meet *every* heating-ventilating need.
- **WIDER RANGE**—Nine sizes—1, 2 or 3 fan models—from 1,250 to 33,000 cfm. Floor, ceiling or wall hung types.
- **LONGER LIFE**—Casing is of uniframe construction, with heavy gauge phosphatized steel. Fan shafts are solid (not hollow), large diameter for minimum vibration. Fan bearings are mounted *externally* for easy maintenance.
- **LOWER COST**—Greater coil and fan efficiency and multiple coil choice permit selection of equipment that meets requirements *exactly*. No wasted capacity! Highly improved production methods and basic design provide low cost de luxe equipment for any application.



FAN ASSEMBLY. Torrivents feature the latest and finest in a centrifugal forward curved fan—the new TRANE Model 31—for reduced outlet velocities, quiet operation. Close tolerances and refinement of blade curvature and design provide lower speeds for equivalent performance. Oversized, balanced, *solid* fan shafts, self-aligning bearings, lock-seam fan housings make for rugged dependability.

For heating, cooling, ventilating... For any air condition, turn to

TRANE

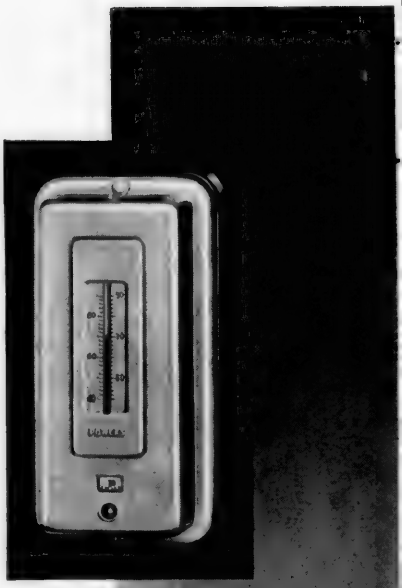
MANUFACTURING ENGINEERS

The Trane Company, La Crosse, Wis. • Eastern Mfg. Div., Scranton, Pa.
Trane Company of Canada, Ltd., Toronto • 90 U.S. and 19 Canadian Offices

POWERS Temperature Control

in 1915 and POWERS AGAIN in the

new Highland Park High School



"Because of the many years of dependable control obtained from Powers equipment and the prompt service received whenever required in our old buildings, another Powers temperature control system was installed in our new high school which was planned to meet the needs of 2,000 students"

. . . Mr. E. W. Zaeske, Supt. of Buildings and Grounds.

Functional and architectural features of Highland Park's new high school have been carefully executed to conform to the highest quality of modern school design and to meet the stipulation of keeping future maintenance costs at a minimum.

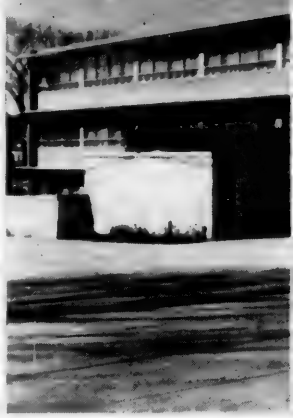
Since 1891, Powers temperature control systems have been noted for their low operating and low maintenance cost. 25 to 50 years of dependable operation with a minimum of repairs is reported by many satisfied users.

Comfort and Fuel Economy in the 87 classrooms and other spaces here are provided by a Powers control system which regulates the following heating and ventilating equipment:

A Powers MASTROL system regulates the temperature of the forced hot water supplied to convectors under the control of a Powers thermostat for each space. Ventilation is provided by Powers controlled fan units located throughout the buildings.

Natatorium is Unique in that provision is made for the comfort of spectators as well as the swimmers. Convectors in the pool area maintain air at 86° F. while spectators are blanketed with air at 76 to 78° F.

If You Are Planning a New School or remodelling an old one, ask your architect or engineer to include a Powers Quality system of temperature control. You will help insure utmost comfort and lowest upkeep cost.



Photos: Hube Henry, Hedrich-Blessing

THE POWERS REGULATOR COMPANY

SKOKIE, ILLINOIS | *Offices in chief cities in U.S.A., Canada and Mexico*

65 Years of Automatic Temperature and Humidity Control

POWERS CONTROL

Symbol of Economy and Quality Control

(c81)

Typical Classroom

Library

Band Room in Music Dept.

Highland Park, Illinois, High School

Loebl, Schlossman & Bennett, Architects
Samuel R. Lewis, Consulting Engineer
Gust K. Newberg Co., General Contractor
Adelman Heating Corp., Heating Contractor
All of Chicago, Illinois

Photos below show one of the 87 classrooms and some of the other spaces controlled by POWERS

Cafeteria and Multi-Purpose Room

Exhibition Gymnasium

Swimming Pool 50 x 75 ft.

here's what heating and ventilating contractors say about INLAND TI-CO®

Galvanized Steel

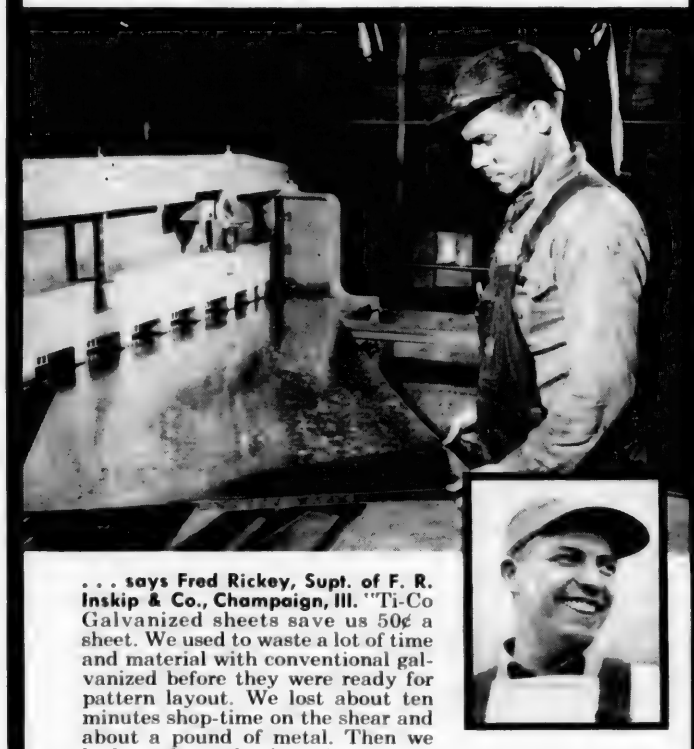
. . . says James N. Johnson, Shop Supt. of The Austin Sheet Metal Co., Chicago, Ill. "Ti-Co keeps our labor costs down! When you're the sheet metal contractor for large housing projects involving hundreds of homes, such as the Brynhaven development in Elmhurst, it's necessary to keep a large inventory of fittings in stock. Mass production of sheet metal fittings can be costly if you're having trouble with cracking and flaking of the "iron". That's why we like Inland's Ti-Co. We never have to waste time and money doing an intricate fitting over again because Ti-Co's coating never comes off."

. . . says P. W. Olmen, President of Jamar-Olmen Co. and W. A. Kuechenberg, President of R. B. Hayward Co., co-contractors of the sheet metal work on Chicago's new Prudential Building. "We used Ti-Co exclusively for all the duct work for air handling in the Prudential Building. Over 1,000 tons went into the job in all . . . the largest single air handling sheet metal job ever undertaken in Chicago. With Ti-Co we knew we could depend on getting uniformity of coating and base metal."

. . . says Maurice L. De Wulf, heating contractor of Roselle, Illinois. "Ti-Co Galvanized sheets cut my fabrication costs 20 to 25%! Figure for yourself what it costs to form a 10-foot heating duct with a Pittsburgh lock seam. Then if the zinc coating flakes or peels along the seam—*just double the cost!* The job has to be done over, and though you may be able to salvage some of the material, you can't salvage those wasted man-hours."

. . . says Mr. Earl Rocky, Supt. of O. A. Wendt Co., Chicago, Ill. "I wouldn't use anything but Ti-Co in my shop. We have been using close to 500 tons of Inland Ti-Co per year for the past several years and I have yet to have a sheet flake on me. Even on the lockseamer, and we make our seams especially tight, Ti-Co performs beautifully. Ask any of the boys in my shop and they'll tell you the same thing."

. . . says H. G. Prizant, Owner and Manager of H. G. Prizant Co., Chicago, Ill. "We depend on Ti-Co for our profit. Take this intricate installation in the new University of Illinois Dentistry Building, for example. Although the galvanized steel cost less than $10, there was probably about $250 worth of labor in this piece. If the sheets cracked along the lock seams, or even if their zinc coating had flaked off severely, it would have meant re-doing the entire job. With Ti-Co we don't have to worry about re-doing jobs because of steel failure."



. . . says Fred Rickey, Supt. of F. R. Inskip & Co., Champaign, Ill. "Ti-Co Galvanized sheets save us 50¢ a sheet. We used to waste a lot of time and material with conventional galvanized before they were ready for pattern layout. We lost about ten minutes shop-time on the shear and about a pound of metal. Then we had to refigure the sheet size to make a layout. We don't have this waste using Inland Ti-Co sheets. They're always uniform. We make layouts and shear Ti-Co as delivered. And we save at least $2,500 a year."

Yes, more and more sheet metal contractors throughout the middle west are learning the tremendous difference between Ti-Co and just any conventional galvanized sheet. Inland Ti-Co is made by a special continuous galvanizing process which eliminates the brittle iron-zinc layer that causes conventional galvanized coatings to flake.

Ask your dealer for Inland Ti-Co and look for this stencil on all your galvanized sheets.

INLAND STEEL COMPANY

38 South Dearborn Street • Chicago 3, Illinois

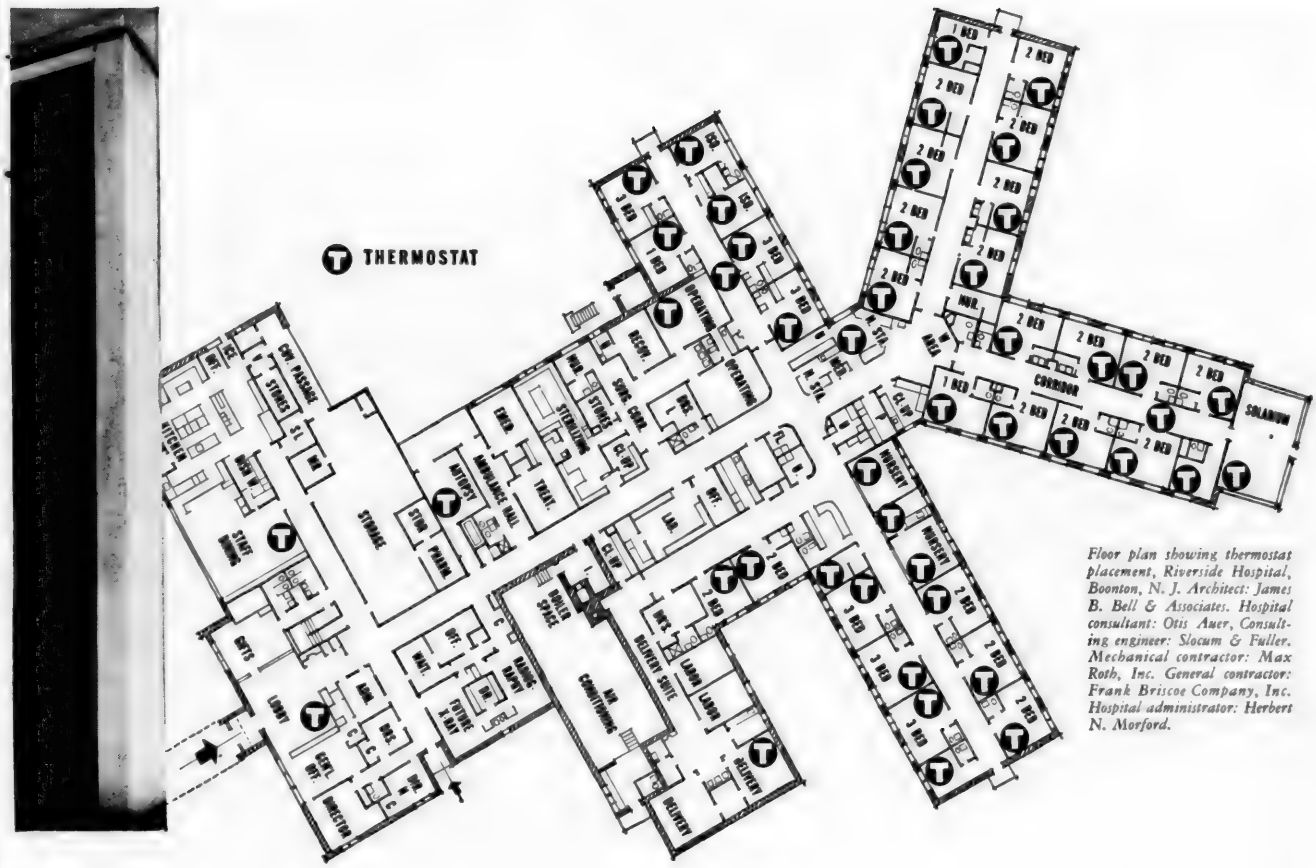
Sales Offices: Chicago • Milwaukee • St. Paul • Davenport St. Louis • Kansas City • Indianapolis • Detroit • New York

Low-cost New Jersey hospital shows how

Honeywell can help you satisfy

Thermostat on the wall gives occupants of Riverside Hospital bedside temperature control. Patients have only to dial the temperature that suits them best. The Honeywell thermostat then maintains it accurately and dependably, regardless of the room's exposure or changes in the weather outdoors. Every patient bedroom is thermostat-equipped.

Use factor helps determine building's control needs. In the operating rooms, for example, temperature requirements are not the same as in patient bedrooms. Number of people present in some areas varies, creating still another type of control problem. In all cases, Honeywell thermostats precisely control heating, cooling and ventilating as needed.



Floor plan showing thermostat placement, Riverside Hospital, Boonton, N. J. Architect: James B. Bell & Associates. Hospital consultant: Otis Auer, Consulting engineer: Slocum & Fuller. Mechanical contractor: Max Roth, Inc. General contractor: Frank Briscoe Company, Inc. Hospital administrator: Herbert N. Morford.

any client's indoor weather needs

Honeywell Customized installation gives patients Bedside Temperature Control, assuring ideal comfort

RIVERSIDE Hospital is the result of careful planning and active cooperation among civic leaders of Boonton, New Jersey. Now Boonton has an attractive 65-bed hospital, in keeping with the latest industrial engineering principles.

In a busy hospital indoor comfort needs vary widely. To meet them, Riverside's planners wisely chose Honeywell Customized Temperature Control for the heating and air conditioning system.

Its flexibility makes the Honeywell installation ideal. In air-conditioned spaces such as the operating room, it maintains temperatures at precise levels winter and summer. During the heating season patients in every room enjoy individual room temperature control. And in other areas, strategically placed Honeywell thermostats compensate quickly and accurately for exposure and changes in weather, use and occupancy.

That's what "customized" means—a control installation fitted to the needs of the building and its occupants, in heating and cooling, in ventilating, and in controlling humidity.

True customized control can best be provided by Honeywell. For only Honeywell manufactures all three types of controls—pneumatic, electric, electronic—which permits Honeywell to make truly objective recommendations.

Whether it's a hospital, factory, bank or store—any building of any size, new or existing—Honeywell Customized Temperature Control can help solve your clients' control problems.

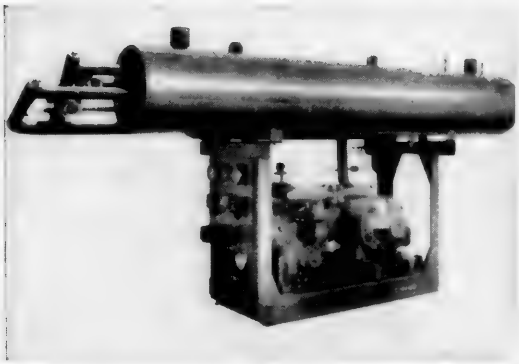
For full details of Honeywell Customized Temperature Control, and the economical Periodic Maintenance Plan, call your local Honeywell office. Or write Honeywell, Dept. HV-11-139, Minneapolis 8, Minn.

MINNEAPOLIS **Honeywell**

Customized Temperature Control

112 offices across the nation

Florida motel orders "seconds" on Worthington air conditioning



Low-cost operation of Worthington packaged liquid chillers stems from exact matching of capacity control to load requirement. Easy installation, long life and wide selection are other key features.

Providing an attractive climate indoors and out has paid off so well for the Azure Tides Motel that they're adding a second building.

The cool, comfortable indoor climate is provided by Worthington's 25-ton packaged chiller (at left) and 15-ton condensing unit. So sold on Worthington air conditioning are the Azure Tides people that the new structure will be cooled by a second Worthington central system consisting of a 25-ton package chiller and a 15-ton condensing unit.

Located on Sarasota's Lido Beach, this handsome two-story motel owes its growing popularity to a choice location, modern comfortable appointments and service geared to the guests' convenience.

Both the original 50-unit building (above) and the 38-unit addition (three-story construction with elevator, modern restaurant and cocktail lounge) were blueprinted by Designer Frank C. Martin and built by General Contractor Charles Ongheri of Sarasota.

For information on air conditioning units to meet your residential, business or industrial needs, call your local Worthington distributor. Or write for Bulletin WP-1099 B48 to Worthington Corporation, Air Conditioning and Refrigeration Division, Section A.6.70-R, Harrison, New Jersey. A.6.70

WORTHINGTON

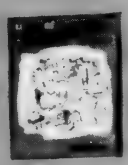
CLIMATE ENGINEERS TO INDUSTRY, BUSINESS AND THE HOME

Special Tank Fabrication Problems?

If you have a special fabrication problem that involves tanks—*Novelty has a two fold solution!*

FABRICATION Novelty has over fifty years' experience engineering and building tanks of steel, stainless steel, copper, nickel, monel and all clads. Novelty offers a wide range of experience with heating elements to meet all heating problems.

LININGS Our Novelon Lining Department can offer solutions to most corrosion problems thru the use of rubber, lead, copper and the new plastic linings that allow much higher heat resistance. Considerable savings are often possible by specifying a Novelon Lining instead of more expensive steel alloys—with protection against corrosion guaranteed.



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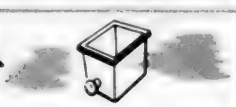
STEAM BOILER WORKS, INC.

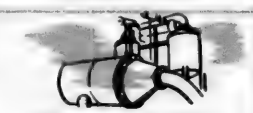
FIFTY YEARS OF FABRICATING
UNFIRED PRESSURE VESSELS

HOT WATER GENERATORS

STORAGE TANKS



SPECIAL LININGS



SPECIAL FABRICATION

NOVELTY STEAM BOILER WORKS, INC.
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SUBSIDIARY OF ELLICOTT MACHINE CORPORATION

Jenn-Air Belt Drive Roof Exhauster with cover removed. Fewer parts and superior engineering assure long life and smooth, quiet operation.

INDUSTRIAL FANS TOO... Can Meet Modern Design Requirements

The trim beauty of low contour Jenn-Air Roof Exhausters complements architectural design.

JENN-AIR belt drive

power roof exhausters complement the roof lines of today's buildings

Modern factory and commercial buildings are being planned for appearance as well as utility. Jenn-Air's years-ahead design meets both requirements. No longer is it necessary to rely on industrial-type exhausters of out-dated design, to meet the higher capacity requirements. Instead, Jenn-Air's Belt Drive Roof Exhausters combine low contour streamlining with new rugged construction.

Every part is carefully engineered to the most rigid standards. The BRIDGE BUILT POWER UNIT is completely isolated from the base to eliminate vibration and sound transmission. Heavy gauge all aluminum construction—same as in the popular Jenn-Air Direct Drive Exhausters—gives strength without weight... saves maintenance dollars.

There's a Jenn-Air Belt Drive Roof Exhauster to solve your industrial or commercial ventilating problem. Available in a range of sizes to 24,000 CFM. . . all with the same spun aluminum low contour beauty.

Jenn-Air Exhausters are rated in accordance with the Standard Test Code by the Texas Engineering Experiment Station.

JENN-AIR PRODUCTS COMPANY, INC.

1102 Stadium Drive, Indianapolis 7, Indiana

427 miles of heating dependability

ASSURED FOR N.Y. STATE THRUWAY!

FIRST... By Sarcotherm Weather-Compensated Control Systems for all 40 Toll Interchanges

AND NOW... By Sarco Heating Specialties for 23 Service Areas

ON THE NEW YORK STATE THRUWAY, there are now 23 restaurant-gas service areas and 40 toll interchanges along the 427 miles of this great vehicular artery... from New York to Buffalo.

Each of these service areas and toll interchanges has its own heating plant. Therefore, dependability of equipment is of vital importance... for faulty operation or breakdowns would mean heating headaches and call-backs all along 427 miles of highway.

That is one of the principal reasons for the installation of Sarcotherm Weather-Compensated Control Systems for the hot water heating of *all* 40 toll interchanges... and of Sarco Steam Heating Specialties for *all* the 23 service areas now completed.

For undivided responsibility on your installations, specify and order from one "Complete Line" source ... SARCO-SARCOTHERM ... heating specialties, temperature regulators, condensate and vacuum pumps, finned tube radiation, and weather-compensated control systems for steam and hot water heating. Write for catalogs.

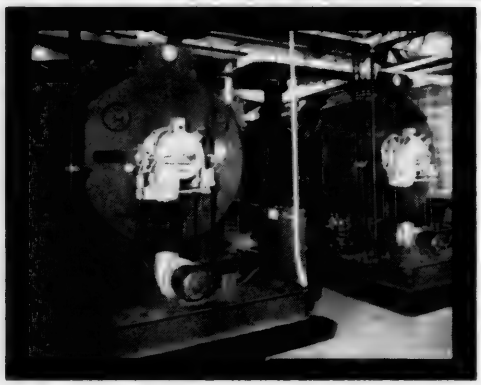
SERVICE AREAS—Architect: Eggers and Higgins. Consulting Engineers: Jaros, Baum & Bolles. Heating Contractors: Joseph Davis, Inc.; Mechanical Installations, Inc.; Harry Hoyle Contracting Co.

TOLL INTERCHANGES—Mechanical Engineers: Syska & Hennessy, Inc. Heating Contractor: Mechanical Installations, Inc.

SARCOTHERM

Sarcotherm Controls, Inc. • Sarco Company, Inc.
Empire State Bldg., N. Y. C.

a NEW concept of distinguished hospitality served by *Powermaster*® low-cost steam



Two 125 hp *Powermaster* boilers supply all steam and hot water for 103 guest rooms, two large dining rooms, bar and cocktail lounge, all kitchen and service facilities at Cherry Hill Inn.

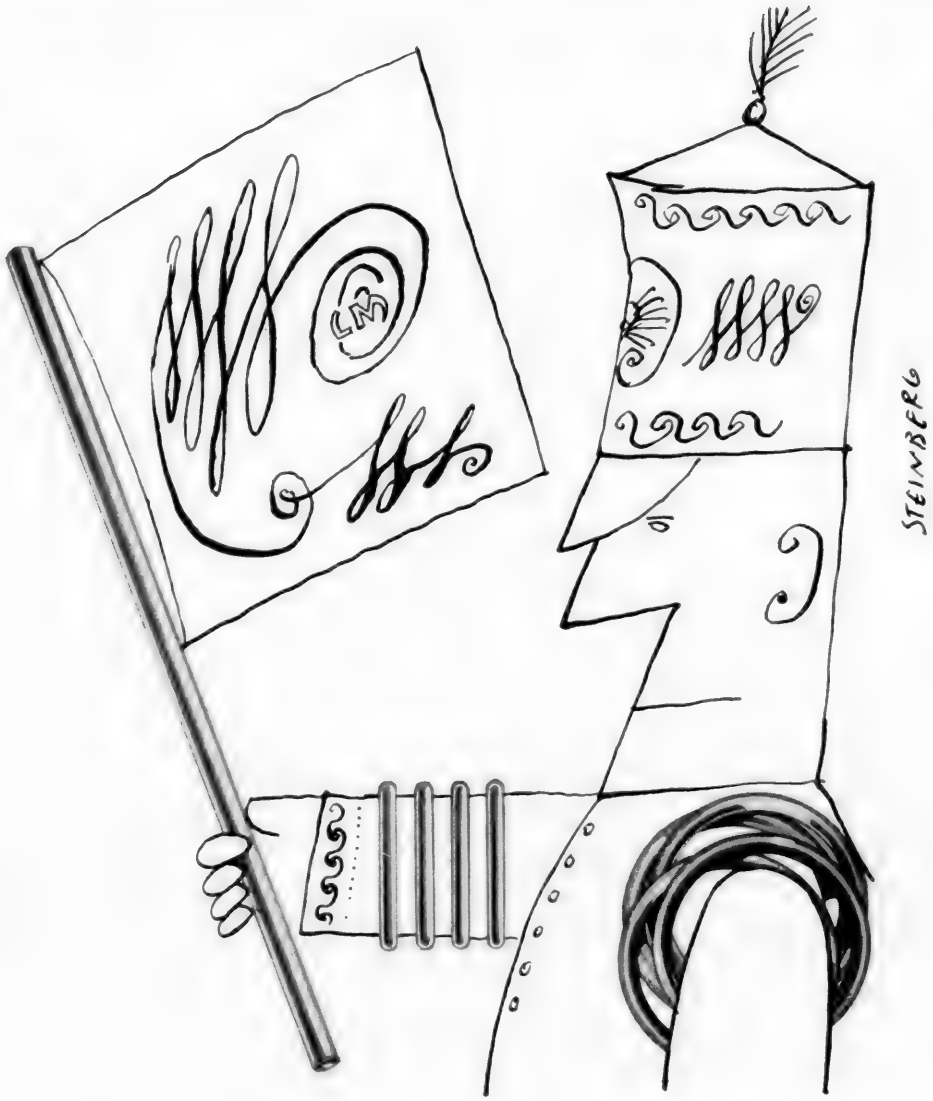
* *Architect:* Arthur Froelich, Los Angeles, Calif.
Mechanical Engineer: Albert A. Hellman Los Angeles, Calif.
Heating Contractor: Ambrose-Augusterfer Corp. Philadelphia, Pa.

• The Cherry Hill Inn combines the gracious comfort and service of a metropolitan hotel with the ultra-convenience of a good motel. Located in New Jersey near Camden and Philadelphia, it offers a delightful new experience in suburban hotel living.

Efficient and dependable heating was a chief concern of the architects and builders, and in keeping with their policy of choosing highest quality materials and equipment, *Powermaster* boilers were installed. Their modern packaged design permitted quick and easy installation in a small space. Automatic controls hold operating time to a minimum. Call in a *Powermaster* representative for full details. Request Bulletin 1220.

Powermaster®
PACKAGED AUTOMATIC BOILERS
Sizes to 500 hp; pressures to 250 psi

ORR & SEMBOWER, INC.
Established 1885
Morgantown Road, Reading, Pa.



One of a series appearing in **FORTUNE** *and leading architectural magazines.*

top brass

Relax our standards? Never!

Lewin-Mathes' rating in the Copper Tube and Pipe Field is *Specialist—1st Class.* With production and distribution facilities designed specifically for our sole specialty, we can't risk jeopardizing the ready acceptance enjoyed by Lewin-Mathes products.

That's why our plant is completely integrated . . . so we *ourselves* can control quality from raw material to packaged tube. And our 25 Branch Offices and 36 Mill Depots often enable us to provide overnight service when needed.

Consult with the "top brass" handling your next plumbing, heating or air conditioning installation about standardizing on Lewin-Mathes Seamless Copper Tube and Pipe. Our singleness of purpose is your guarantee of *perfection!*

LEWIN MATHES

SAINT LOUIS, MISSOURI

MANUFACTURERS OF
COPPER AND BRASS TUBE, PIPE AND ROD

1. SIX HERMAN NELSON HEATING AND VENTILATING UNITS blanket the Chrysler Corporation's Transmission Plant shipping department doorways. Suspended from the ceiling, they hang out of the way . . . provide quiet operation. Available in heat capacities ranging to one million BTU's.

Architects and Engineers:
ALBERT KAHN ASSOCIATED ARCHITECTS & ENGINEERS, INC.
Detroit, Michigan

Mechanical Contractor:
FREYN BROS., INC.
Indianapolis, Indiana

HERMAN NELSON heating and ventilating equipment chosen for new Chrysler transmission plant

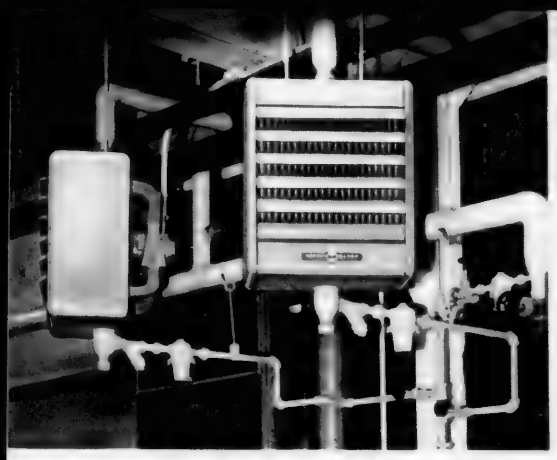
Complete Herman Nelson line . . . at work in Kokomo:

Heating and Ventilating Units
Unit Blowers
Vertical Unit Heaters
Horizontal Unit Heaters
Centrifugal Fans
Exhausters

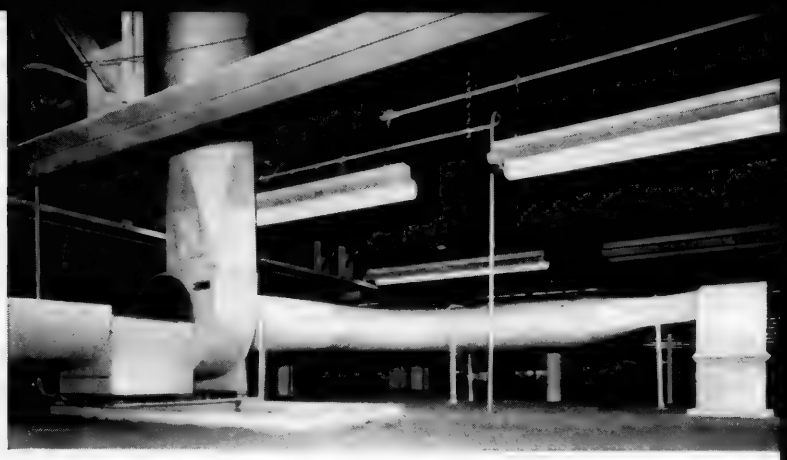
plus AAF Air Filters and Dust Collectors, and Illinois Engineering Steam Specialties

When Chrysler Corporation planned its huge new automatic transmission plant at Kokomo, Indiana, it made certain that all departments would be properly heated and ventilated—and in the most efficient way possible. Selection of Herman Nelson equipment on such a plant-wide scale demonstrated Chrysler's confidence in Herman Nelson.

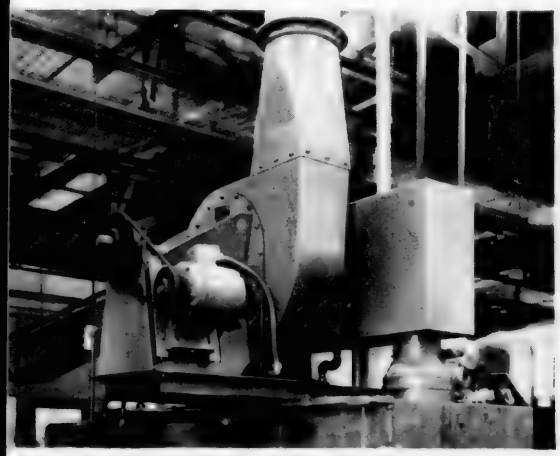
If yours is a problem requiring better air, remember . . . *better air is our business.* You can *depend upon* the quality, performance and efficiency of this *complete* line of air handling equipment. Call on our nation-wide sales and service organization for any help you need.



2. A PAIR OF HERMAN NELSON HORIZONTAL UNIT HEATERS blanket a window area in the penthouse storage area at the Kokomo, Indiana, plant. Using either steam or hot water, compact in design, these heaters are available in 18 sizes.



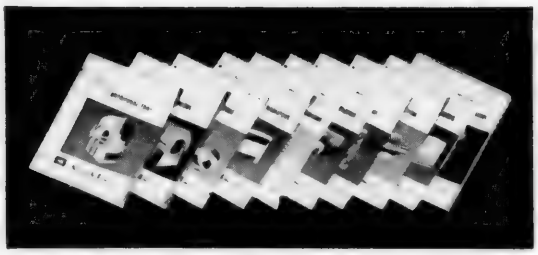
3. HERMAN NELSON UNIT BLOWER used for exhausting the manufacturing area. A completely "packaged" blower, easy to install, the unit features a hinged drive-side cover and outboard sheave that permits complete, easy-to-get-at servicing of belt and motor.



4. A NEW AAF TYPE K INDUSTRIAL EXHAUSTER provides high efficiency in various heat treating operations at the Kokomo plant. Exclusive Taper Lock Hub Assembly on this completely "packaged" unit allows fast, easy changeover on heavy-duty applications where periodic wheel replacement is anticipated. Eliminates the problem of impellers freezing to shafts.

5. HERMAN NELSON CENTRIFUGAL FAN supplying filtered and heated air to main factory area (hot blast system) at the Chrysler plant. AAF air filters and Illinois Engineering steam traps in system were included in this installation. The smaller unit in illustration is a Herman Nelson Unit Blower Size BBZK-1800, exhausting toilet space in penthouse.

6. A HERMAN NELSON VERTICAL UNIT HEATER with louver diffuser discharges air vertically downward or at angle in various directions. Located in the main factory area, it is high on the ceiling, out of the way, yet directing warm air, without drafts, wherever it is needed.



FREE . . . A wealth of useful data is available to you in these NEW, easy-to-read Herman Nelson catalogs. Request the ones you need on your business letterhead.

American Air Filter
COMPANY, INC.
294 Central Avenue • Louisville 8, Ky.

AAF
Herman Nelson

Better Air Is Our Business

From left: American Blower representative H. B. Prewitt; Consulting Engineers C. S. Leopold and F. H. Buzzard of Charles S. Leopold, Engineers; J. G. Hutchins, chief engineer, Philadelphia Trade and Convention Center; Mechanical Contractor J. M. Anderson of W. M. Anderson Co.

They planned air conditioning for a million people!

American Blower teams up with engineer and contractor to air condition Philadelphia's Convention Hall. Result: a system that provides indoor comfort for a million people a year.

On June 28, 1955, Philadelphia's famous Convention Hall (above) became the first facility of its kind in the U.S. to be fully air conditioned.

Everything about the system is on a fabulous scale. For example: The air-conditioned area is 202,500 sq. ft. It is designed for peak loads of 18,700 people. There is a complete air change every five minutes. System provides precise control of indoor temperature, humidity, odor level, air motion, air cleanliness in arena, stage, exhibition hall, grand ballroom, restaurant, foyer, corridors, etc.

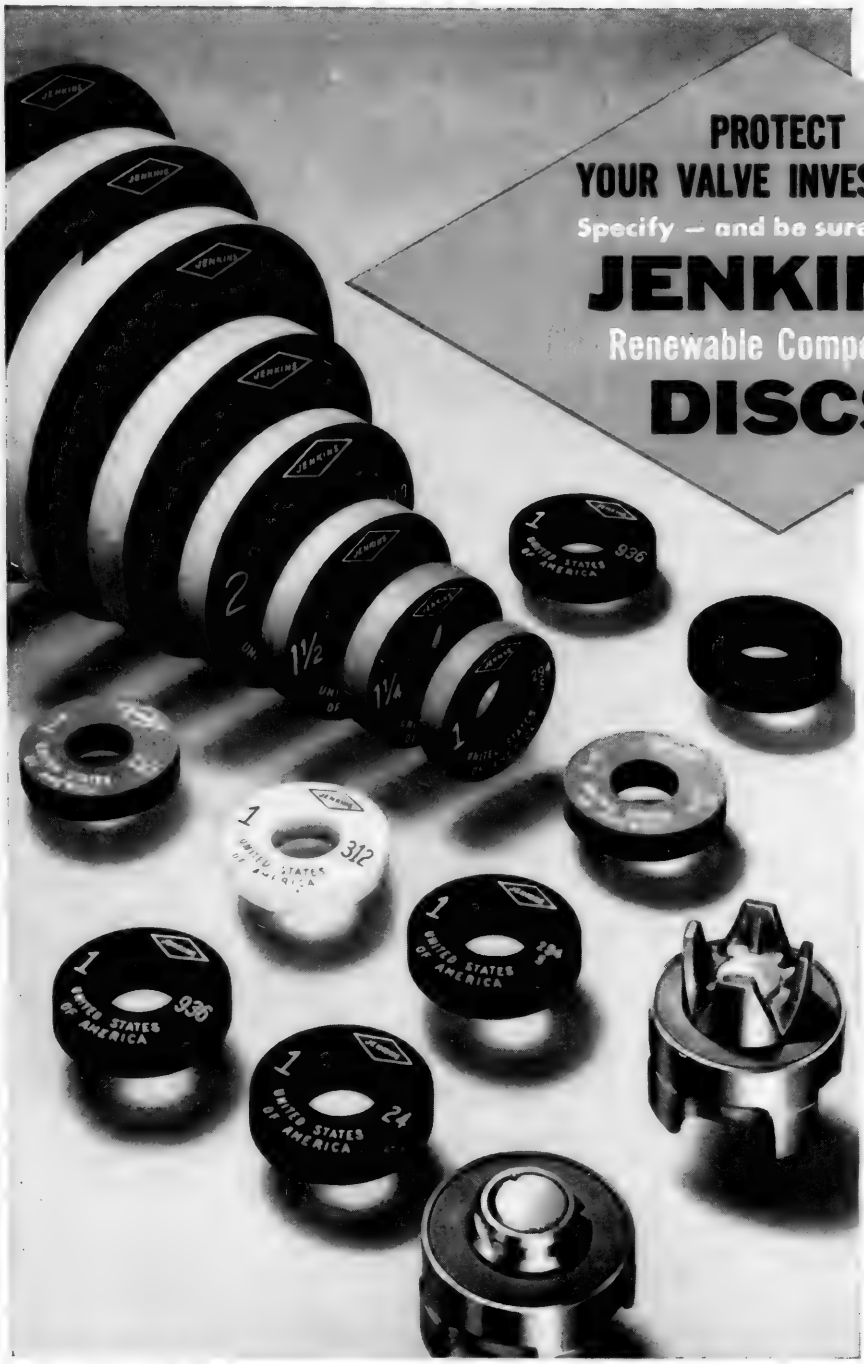
Naturally, this complex job demanded top-notch air-handling and air-conditioning equipment. American Blower was chosen as a major supplier. Some reasons: says Consultant C. S. Leopold, "American Blower is a leader in the industry; its equipment is consistently reliable." Relates Air Conditioning Contractor J. M. Anderson, "We have found American Blower products to be among the best obtainable. They have been on our list of preferred suppliers for over fifty years."

If *your* plans include air conditioning – whether it's a large-scale central or zone system, or a system for a small industrial plant or store – call your nearest American Blower branch office. You'll get quality products you can depend on, plus helpful local service every step of the way. American Blower Corporation, Detroit 32, Michigan. In Canada: Canadian Sirocco products.

AMERICAN BLOWER

Division of AMERICAN-Standard

Air-conditioning equipment for every business



LOOK FOR THE
JENKINS DIAMOND

PROTECT YOUR VALVE INVESTMENT

Specify — and be sure you get

JENKINS

Renewable Composition

DISCS

MADE BY THE ORIGINATORS OF RENEWABLE DISC VALVES

Jenkins Bros. has remained the leader in composition disc development and production since 1864, when the first renewable disc valve was introduced.

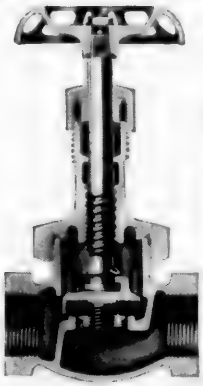
THE ONLY MANUFACTURER OF BOTH VALVES AND DISCS

Jenkins Bros. devotes continuous laboratory and field research to disc improvement through use of new compounds, and new production techniques.

NEW GUIDE FOR DISC SELECTION

Describes all Jenkins Discs, and their applications for steam, hot and cold water, air, gas, oil, gasoline . . . including the new TEFLON® DISC for lasting, dependable control of oxygen and other gases, solvents, acids, alkalies, and other chemicals,— and for liquid food and similar services.

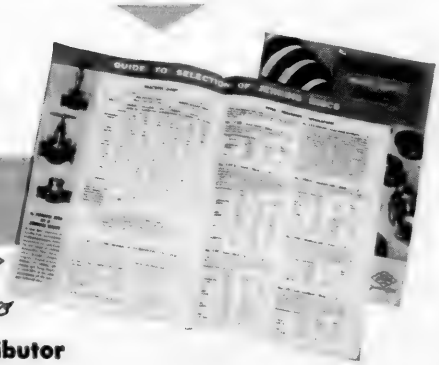
Ask your Jenkins Valve Distributor for Disc Folder Form 203, or write: Jenkins Bros., 100 Park Ave., New York 17.



. . . for highest efficiency, use the time-proved combination . . . JENKINS DISCS in

JENKINS VALVES

TRADE JENKINS MARK
Jenkins Bros



Order from Your Local Jenkins Distributor

PERMANENT WATER BARRIER

for hot underground pipes

Anyone can install Tri-sul-ite. It is supplied in 100 lb. black and silver bags and merely poured around the pipes in the ditch, tamped and cured.

TRI-SUL-ITE

3-WAY PROTECTION SYSTEM

(formerly INSUL-ITE)

- Water cannot follow the grade of the pipe
- Prevents corrosion
- Excellent insulating value
- Very low material and installation costs
- Speediest, simplest installation
- Eliminates maintenance
- Easily adaptable to future pipe changes

WHAT DOES TRI-SUL-ITE DO?

Tri-sul-ite is a specially selected and granulated gilsonite. After being poured and tamped around the pipes, it forms, by proper curing, 3 *permanent* zones for protecting against water, corrosion and underground heat loss. The first zone adjacent to the pipe fuses, from pipe heat, into an impermeable, water- and corrosion-proof coating. The second zone of partially fused material has excellent insulating properties. The third zone of unfused Tri-sul-ite granules provides maximum insulating efficiency plus unusually high resistance to water penetration.

Tri-sul-ite comes in three types:

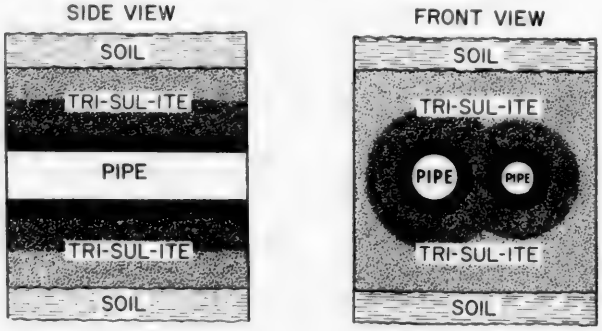
Type 1 for pipe temperature range between 220°F. and 300°F.

Type 2 for temperature range between 300°F. and 385°F.

Type 3 for temperature range between 385°F. and 520°F.

OTHER SPECIAL ADVANTAGES

- No extra housing required. Tri-sul-ite forms its own protective covering.
- Only normal pipe spacing is needed. Ells, loops and multiple pipe lines present no difficulty whatsoever.
- When you use Tri-sul-ite you obtain expert field service and installation guidance by qualified engineers.



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GENERAL OFFICES

G. S. ZIEGLER & COMPANY

GREAT NECK, N. Y.

MINES: CASTLE PEAK · LITTLE BONANZA · LITTLE EMMA · PROCESSING PLANTS: CRAIG, COLO. · PROVO, UTAH

ZICO

Bendix burns coal the modern way, cuts fuel costs 19%

Consult an engineering firm

Designing and building hundreds of heating and power installations a year, qualified engineering firms can bring you the latest knowledge of fuel costs and equipment. If you are planning the construction of new heating or power facilities—or the remodeling of an existing installation—one of these concerns will work closely with your own engineering department to effect substantial savings not only in efficiency but in fuel economy over the years.

facts you should know about coal

In most industrial areas, bituminous coal is the lowest-cost fuel available • Up-to-date coal burning equipment can give you 10% to 40% more steam per dollar • Automatic coal and ash handling systems can cut your labor cost to a minimum. Coal is the safest fuel to store and use • No smoke or dust problems when coal is burned with modern equipment • Between America's vast coal reserves and mechanized coal production methods, you can count on coal being plentiful and its price remaining stable.

At its Products Division, South Bend, Ind., Bendix Aviation Corporation undertook extensive modernization of its power system. The firm replaced two 511 HP boilers with two 80,000 lb./hr. spreader stoker fired units. A 500-ton overhead bunker and coal elevator-conveyor system were installed. Additional changes were made including an increase in the capacities of the water and air systems.

Today fuel costs at Bendix have been cut 19%, efficiency boosted from 70% to 82%, maintenance costs lowered 80% and availability upped from 50% to 96%. By burning coal the modern way, Bendix is saving many thousands of dollars yearly and will amortize the cost of modernization in a comparatively short time.

For further information or additional case histories showing how other plants have saved money burning coal, write to the address below.

BITUMINOUS COAL INSTITUTE
Southern Building • Washington 5, D. C.

UNIFORM THREADING OF YOUNGSTOWN PIPE

makes your job easier, quicker

. . . yet more efficient

7 Points of uniform goodness in YOUNGSTOWN PIPE

- uniform ductility
- uniform lengths
- uniform threading
- uniform weldability
- uniform wall thickness and size
- uniform strength and toughness
- uniform roundness and straightness

Pipe fitting can be trouble free when threads are perfect. Couplings, tees, elbows roll on smoothly with no effort, tighten up with leakproof sureness. There aren't any stoppages or delays—no rattled nerves, no skinned knuckles, no recut threads. You've a quality job and satisfied customer.

You'll appreciate the uniform threading point of goodness -- like the other 6 points of uniform goodness -- in Youngstown Pipe. That's why it will pay you to specify Youngstown for all your pipe needs.

Youngstown PIPE

QUALITY YOUNGSTOWN SERVICE

THE YOUNGSTOWN SHEET AND TUBE COMPANY

Manufacturers of Carbon, Alloy and Yoloy Steel

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SHEETS - STRIP - PLATES - STANDARD PIPE - LINE PIPE - OIL COUNTRY TUBULAR GOODS - CONDUIT AND EMT - MECHANICAL TUBING - COLD FINISHED BARS - HOT ROLLED BARS - WIRE - HOT ROLLED RODS - COKE TIN PLATE - ELECTROLYTIC TIN PLATE - BLACK PLATE - RAILROAD TRACK SPIKES - MINE ROOF BOLTS

NERVE CENTER
for *"CONTROLLED CLIMATE"*

with **VARI-VAC** differential heating systems

- Centralized controlled adjustment of vacuum or pressure, *automatically* adjusts heat medium to balance with varying heat loss of a building due to changing outside weather conditions.
- Uses less fuel. Cuts costs up to 40%.
- Minimum room temperature variations.
- Equal steam distribution to all radiators regardless of location and heat demand.
- Quiet operation and low maintenance.

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Air Conditioning, Refrigeration, Heating Products and Accessories
DUNHAM-BUSH, INC., WEST HARTFORD 10, CONN., U.S.A.

DUNHAM-BUSH, INC. Dept. AHV
West Hartford 10, Conn.

Send me free VARI-VAC bulletin and specifications.

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Company.....
Street.....
City..... Zone..... State.....

...SO HALSTEAD & MITCHELL ENGINEERS DESIGNED

AIR-COOLED CONDENSERS FOR SIMPLER MULTIPLE CIRCUITING

Selecting circuits and manifolding when connecting several air conditioning and refrigeration units to a single remote air-cooled condenser can be expensive unless the air-cooled condenser is designed for the simplicity that means low labor costs.

That's why it's real news that Halstead & Mitchell engineers have devised a remote air-cooled condenser especially for extra-easy multi-circuiting. As costs come down, your sales go up.

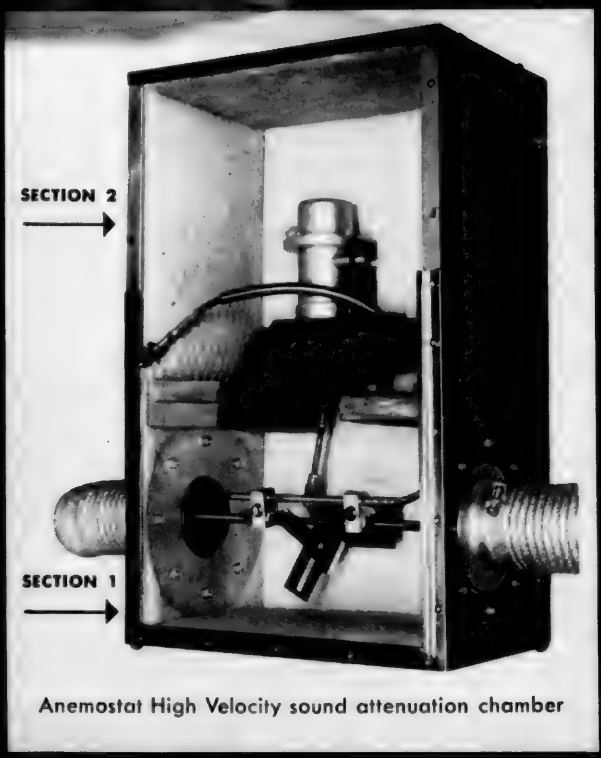
The Halstead & Mitchell Air-Cooled Condenser has been designed with several *no-cost* extras like this easier multiple circuiting. Only Halstead & Mitchell offers, for instance, "Turbu-Flo"® finned surface which provides added heat transfer to give you *extra-safe* capacity ratings. No need to worry when *you* recommend H & M.

There are extra years of working life, too, for Halstead & Mitchell's superiority in cooling tower steel protection has been used to keep air-cooled condensers free from rusting. The tubing assembly is self-reinforcing, locking out vibration before it starts.

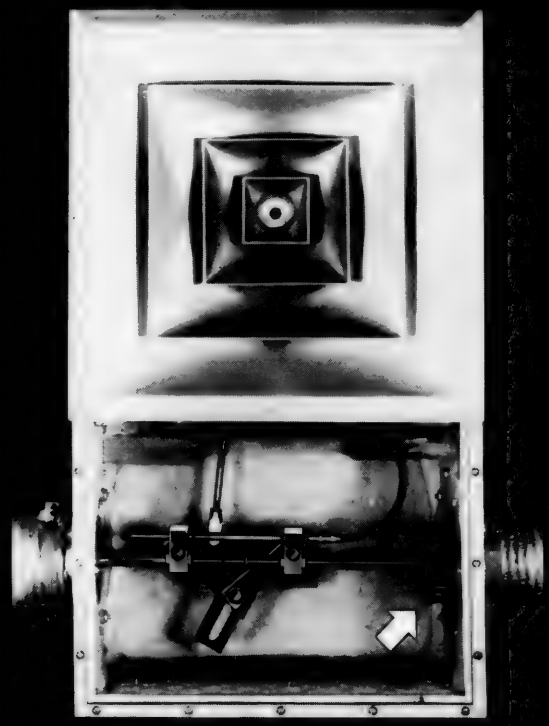
Lifetime ball bearings and deep-pitch, slow-speed fans make for quiet operation. It's the assured operation you look for when you select Halstead & Mitchell, manufacturer of the industry's broadest line of water-saving devices for air conditioning and refrigeration.

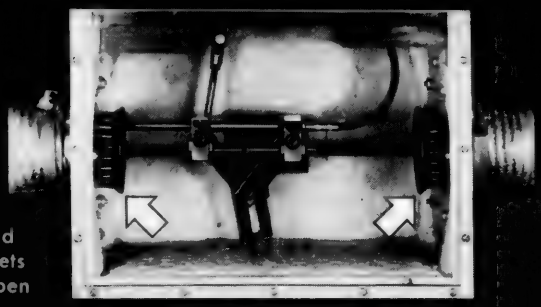
Write for Bulletin AC-100

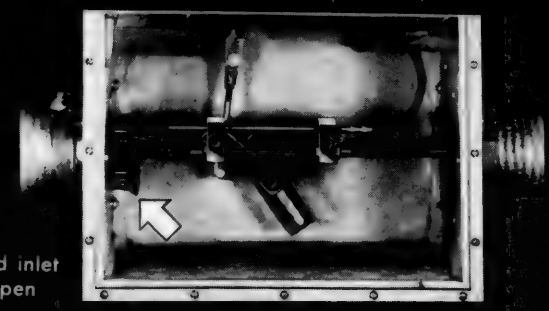
HALSTEAD & MITCHELL · BESSEMER BLDG. · PITTSBURGH 22, PA.



Anemostat High Velocity sound attenuation chamber


Hot inlet open in Section 1.
Anemostat in place covers Section 2


Hot and cold inlets 50% open


Cold inlet open

How to mix and diffuse high velocity air automatically

The Anemostat High Velocity sound attenuation chamber is divided into two sections. Both hot and cold air from the main risers enter Section 1, which is an acoustically lined blending chamber, in which the volumes of air are controlled by the Anemostat serrated rocket-socket valves. When the thermostat is set, the rocket-socket valves move slowly back and forth, thereby adjusting the volume of air supplied through the hot and cold inlets. The velocity of the air which enters Section 1, at from 3500 to 6000 fpm, is automatically reduced by expansion.

As the blended air meets the temperature requirements of the thermostat, it passes through a baffle arrangement into the acoustically lined Section 2 of the chamber, further reducing the db rating of the air.

The air then passes through the Anemostat Air Diffusers, where the aspiration effect causes mixing of room and supply air within the diffuser, resulting in further temperature equalization. The diffuser then delivers to the occupants of the room draft-free air at the desired temperature.

The Anemostat All-Air High Velocity distribution system offers other important advantages. It can be used with smaller than conventional ducts. It can be installed faster and at less cost. It requires no coils, thus eliminates leakage, clogging and odors. Furthermore, Anemostat round, square and straightline diffusers with high velocity units blend into a wide variety of architectural designs.

Write for 1956 New Products Bulletin and Selection Manual 50 to Anemostat Corporation of America, 10 E. 39 Street, New York 16, N. Y.

Anemostat: The Pioneer of All-Air High Velocity Systems

Type N ROTO-CLONE ▸

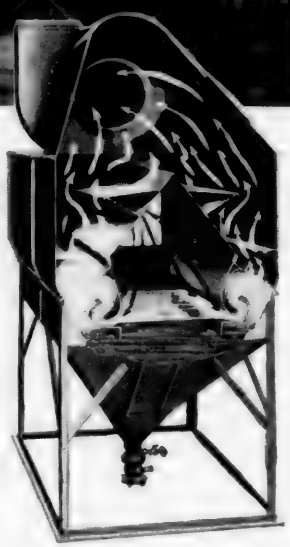
eliminates stack gas nuisance from rotary kiln operations at Westvaco Chemical

The Westvaco Chemical Division, Food Machinery and Chemical Corp. operates two rotary kilns at its Modesto, Calif., plant for processing barite ore. The larger kiln, pictured above, has a capacity of 70 tons per day—the smaller handles 35 tons. Neither pose a dust problem to plant or community, because both are equipped with a Type N ROTO-CLONE.*

High temperature gases and heavy concentrations of coarse and fine particles are invariably associated with rotary kiln operation—and air pollution problems. And that's where the Type N comes to the rescue! This hydro-static precipitator is unaffected by high temperatures; offers high collection efficiency on even small micron particle sizes. When bulk of material is needed dry, as at Westvaco, the ROTO-CLONE is an excellent final cleaner to dry type collectors. Small space requirements, constant exhaust volume and reasonable maintenance are other features recommending the Type N ROTO-CLONE for rotary kiln service.

Write for Bulletin No. 277 today! Remember, it costs less to build goodwill than to battle dust complaints.

**ROTO-CLONE is the trade-mark (Reg. U. S. Pat. Off.) of the American Air Filter Company, Inc., for various dust collectors of the dynamic precipitator and hydro-static precipitator types.*



Type N ROTO-CLONE with hopper designed for sluicing collected material to process or disposal points.

AAF Dust Control Equipment

Illinois Heating Specialties

American Air Filter
COMPANY, INC.

294 Central Avenue, Louisville 8, Kentucky
American Air Filter of Canada, Ltd., Montreal, P. Q.

BETTER AIR IS OUR BUSINESS

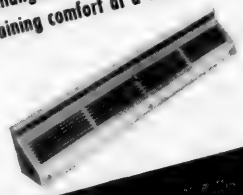
AAF Filters and Precipitators

Herman Nelson Industrial Heaters

...condensed consumer reports
from the files of
standard
registers
and grilles

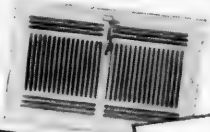
B-24 PERIMETER BASEBOARD DIFFUSERS

Mad Maud used to fume
When air blasts blew her from the room,
But B-24 changed her wrath to revel,
By maintaining comfort at a very high level!



PERIMETER BASEBOARD REGISTER NO. 551

Frozen Frank was in a snit;
found cold corners wherever he'd sit.
But with the 551's four way diffusion,
He now has comfort in profusion!



PH SERIES PERIMETER FLOOR REGISTERS

When Circle Sal entertained the ladies,
They found her home as hot as hades.
PH Registers restored her station,
Through perfect heat regulation!

CEILING AIR DIFFUSERS

Sinus Sam was a martyr true;
Stuffy air turned him blue,
'Til he put Ceiling Air Diffusers in.
Now he's in the pink again!

MORAL: If you want to keep
your customers happy
mail this coupon
and make it snappy!

STANDARD

...first in engineering for indoor comfort

STANDARD STAMPING & PERFORATING CO.
3141 W. 49th Place, Chicago 32, Illinois
Gentlemen: Please send me your new catalog showing the complete line of STANDARD STAMPING REGISTERS AND GRILLES.

Name_____

Company_____

Address_____

City_____ Zone_____ State_____

What's new at the Edgewater Beach?

new recessed year-round room air conditioners by

Mueller Climatrol®

EXTREMELY COMPACT—Attractive, stainless steel louvre opening fits flush to outside of the building.

New at Chicago's Edgewater Beach . . . and comfort news the country over! This great hotel now adds the guest-pleasing plus of personalized comfort to its world-famous service.

Mueller Climatrol year-round air conditioners replace old-fashioned radiators with tasteful, space-saving beauty — heat with existing steam or hot water . . . cool with their own efficient cycle. Result: a complete, thermostatically-controlled heating and cooling system in each room.

CUSTOM COMFORT. Individual room control with push-button selector.

ECONOMICAL TO INSTALL AND OPERATE. About half as much to put in, 20% less to operate than central cooling.

USES NO WATER. Efficient one-hp refrigeration cycle is air-cooled . . . requires no plumbing or drainage.

TENANTS AREN'T DISTURBED. You schedule installation in unoccupied rooms on a rotative basis.

VERSATILE. Heats, cools and dehumidifies . . . ventilates with fresh outdoor air . . . exhausts stale air.

Look to Mueller Climatrol for a complete line of quality heating and cooling equipment for commercial and institutional buildings — fan coils, unit heaters, boilers, heating-cooling combinations and self-contained cooling units. Write for full information.

Mueller Climatrol®

Division of Worthington Corporation

DEPT. 116, 2060 W. OKLAHOMA AVE. • MILWAUKEE 15, WIS.

As Close to You as Your Telephone!

genetron®
Super-Dry Refrigerants

Jenni Genetron Says: **"No matter where you are there's a genetron wholesaler near you!"**

genetron 11 ORANGE LABEL
TRICHLOROMONOFLUOROMETHANE

genetron 12 WHITE LABEL
DICHLORODIFLUOROMETHANE

genetron 141 GREEN LABEL
MONOCHLORODIFLUOROMETHANE

genetron 226 PURPLE LABEL
TRICHLOROTRIFLUOROETHANE

genetron 320 DARK BLUE LABEL
DICHLOROTETRAFLUOROETHANE

FREE! Valuable Folder!
Ask your wholesaler for special folder on *Genetron* Super-Dry Refrigerants. Contains pressure- temperature charts and other helpful information.

Coast-to-coast, America's leading Refrigeration and Air Conditioning Wholesalers feature *Genetron* Super-Dry Refrigerants. There's one as near to you as your telephone ready to supply you with complete stocks of *Genetron* Refrigerants and with up-to-the-minute data on their uses.

Remember—*Genetron* Refrigerants are super-dry! Their moisture content is exceptionally low; their overall purity extremely high. They meet the industry's most exacting refrigerant specifications . . . are freely interchangeable with comparable fluorinated hydrocarbon refrigerants produced by any other manufacturer. Follow the industry-wide trend to Super-Dry *Genetron* Refrigerants. Always ask for *Genetron!*

GC
Allied Chemical

GENERAL CHEMICAL DIVISION
ALLIED CHEMICAL & DYE CORPORATION
40 Rector Street, New York 6, N. Y.
Offices in principal cities

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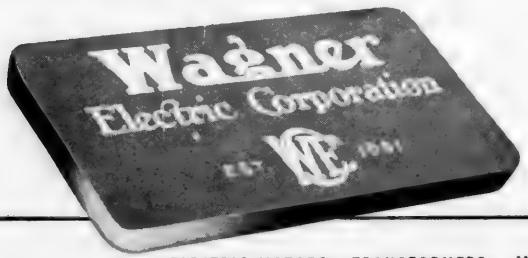
Wagner®
ELECTRIC MOTORS
...the choice of leaders in industry

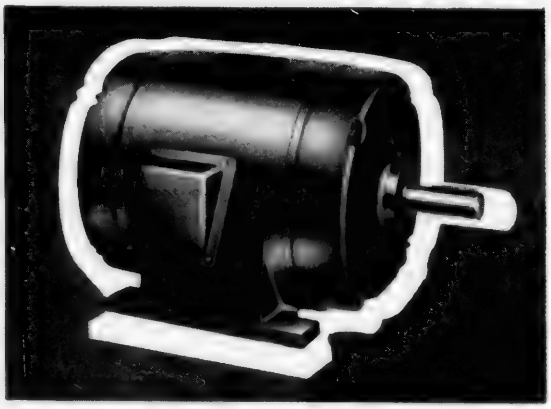
You get better performance with these Wagner DP Motors

Wagner DP motors are *doubly protected* by (1) rugged, corrosion-resistant cast iron frames, smoothly rounded so that no moisture can collect on them. Motor feet are cast as an integral part of the frame for maximum strength and rigidity. (2) Enclosures on the DP motor are completely drip-proof—virtually splashproof. Air intakes are located at the bottom of the endplates and air outlets are located at the base of the frame—one on each side.

Although engineered to meet the re-rated NEMA specifications which call for more power in smaller frames, the same high quality and long life performance that have made Wagner Motors "the choice of leaders in industry" for many years has of course been retained.

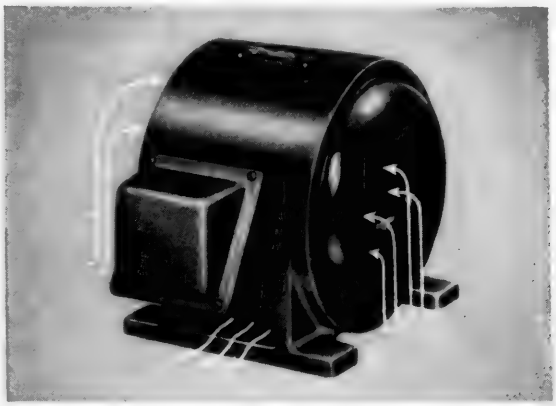
Full information and principal dimensions are given in Bulletin MU-202. Write for your copy today.





MORE POWER IN SMALLER FRAMES The Wagner DP Motor packs more power in a smaller frame and this smaller size means ease of handling and stocking . . . less space required for installation.

CAN BE RE-GREASED FOR LONGER LIFE This motor will operate for years without regreasing . . . bearings are completely enclosed . . . however, provisions have been made for adding lubricant and for the removal of old grease in cases where re-greasing is necessary.



COOL RUNNING Specially designed baffles direct cooling air from the blowers through the motor and provide protection for the stator windings. Blowers are an integral part of rotor . . . and move large volumes of air without noise or vibration.

Wagner Electric Corporation
6463 Plymouth Ave., St. Louis 14, Mo., U.S.A.

BRANCHES AND DISTRIBUTORS IN ALL PRINCIPAL CITIES

M56-4

ELECTRIC MOTORS • TRANSFORMERS • INDUSTRIAL BRAKES • AUTOMOTIVE BRAKE SYSTEMS–AIR AND HYDRAULIC

100 TON BARRIER

Crashing the 100 ton barrier

with KRAMER

UNICON

in semi-tropical climate

UNICON SUCCESSFULLY MET THE TEST THROUGH THE SEVERE SUMMER OF 1955

You, too, can crash the big tonnage barriers with UNICON, the industry's finest remote-type air-cooled condenser. Put Kramer's 18 years of "treasured know-how" in the proper use of air as a condenser coolant to work for you.

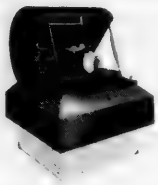
Photo of Kramer UNICONS mounted on roof of Handy-Andy Supermarket in San Antonio, Texas, used with 100 ton air conditioning system. Supplied through United Supply Co., of San Antonio and installed under the direction of Harold Vogt.

Write for Bulletin U-210-L

KRAMER

KRAMER TRENTON COMPANY
Trenton 5, New Jersey

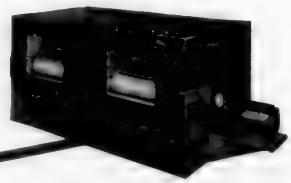
100 TON BARRIER



OUR 76TH YEAR

POWER ROOF VENTILATORS, Propeller Fan Type and Power Fixed (backward curve blade) offer a wide range of sizes. Bulletin No. 119 Propeller Fan Type Bull. 124 Power Fixed Fan Type.

BLOWERS, Squirrel Cage (Forward Curve) and Power Fixed (Backward Curve) Fans available in a complete range of sizes, Single or double width. Bulletin 101 (PF) Bulletin 105 (S.C.).

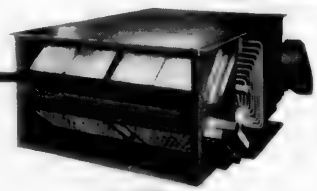


FURNACE FANS, Single, double or special width. All housing and wheel parts are die formed. Available as complete assemblies or parts only. Bulletin No. 115.

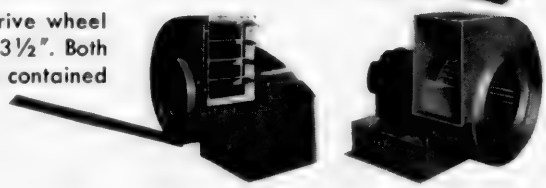
UNIT HEATERS, Blower Type floor or ceiling mounting arrangements, built in sections to facilitate efficient handling and erection. Popular sizes. Bulletin No. 112.

PROPELLER FANS, New Venturi-type Belt drive 24" to 48" wheel diameters, direct drive 12" to 30" diameters. A complete line of accessory items are available. Bulletin 117.

UNIVERSAL BLOWERS, A stock blower assembly made in single or double width, sizes 7" to 27" wheel dia. and features Universal discharge arrangement. Bulletin No. 110.



AIR CONDITIONING UNITS, Seven sizes available, ranging from 1,000 to 14,000 C.F.M. Vertical or horizontal mounting. Designed to combine cooling in summer, heating in winter. Bulletin 120.



VENTILATING SETS, Utility type. Belt drive wheel diameters 7" to 30". Direct drive 6" to 13½". Both available in popular competitive sizes, self contained completely packaged units. Bulletin 109.

The BISHOP & BABCOCK Mfg. Co.

Our challenge stands

—anything that can be made of steel sheets can be made of

WHEELING

SOFTITE®

Galvanized Sheets

Believe it or not, this galvanized recessed ceiling light reflector housing was made by spinning. *"Impossible,"* you say? *"Can't be done with ordinary galvanized steel"?*

You are right! It *isn't* made of ordinary galvanized steel.

It's made of Wheeling SOFTITE, the tightest-coated galvanized sheet yet produced. So tight it won't chip, crack, flake or peel no matter how severely it is formed. It even takes *spinning* in its stride. In fact, *anything* that can be made of steel sheets can be made of Wheeling SOFTITE.

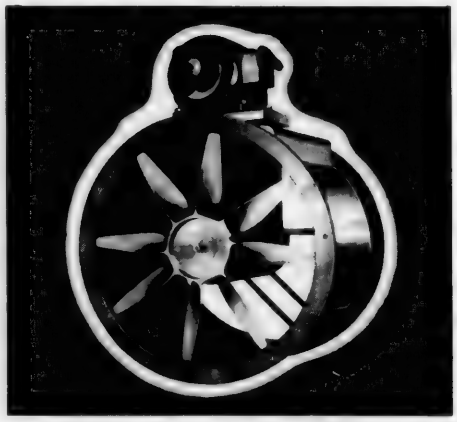
That's SOFTITE . . . made by the same company that developed Cop-R-Loy, the original copper-bearing steel pipe . . . and DUCTILLITE, the original cold reduced tin plate. Now SOFTITE, the ultimate in ductile, tight-coated galvanized steel sheets . . . a product of Wheeling Steel Corporation, Wheeling, West Virginia.

IT'S WHEELING STEEL

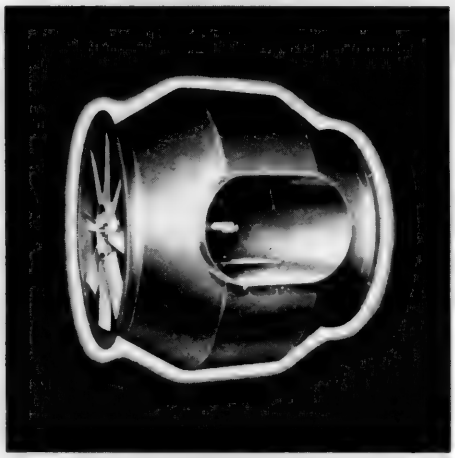
District Offices — Atlanta, Boston, Buffalo, Chicago, Cincinnati, Cleveland, Detroit, Houston, New York, Philadelphia, St. Louis, San Francisco

there's a HARTZELL fan or blower to power any ventilating system

Hartzell Duct Fans



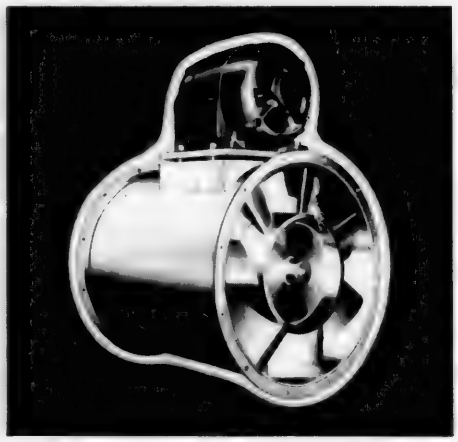
Say good-by to high installation and maintenance costs when you choose a Hartzell Duct Fan. Built as a prefabricated duct section, it bolts into place easily in any duct system, leaving the motor readily accessible for maintenance. This rugged and reliable fan fits any duct system for removal of flammable fumes, corrosive elements, or abrasive dust. Sizes from 12" to 60" in both belt-drive and direct-drive models.



The *NEW* Hartzell Bi-Pass Duct Fan

Here is the ideal fan for high temperature operations such as ovens and oil and gas fired induced draft boilers and for moving corrosive fumes. Designed with the motor mounted in a tunnel out of the air stream, the Bi-Pass Duct Fan is available in diameters from 19" to 41". Operates in temperatures to 300° in standard construction, to 550° with special high-temperature, heavy duty construction.

Hartzell Vaneaxial Blowers



These rugged units are designed for trouble-free performance and long life in punishing industrial applications. All welded, heavy gauge steel construction. Ten belt drive sizes, 12" to 54", six direct drive sizes, 18" to 42". The new High-Temperature model moves air at temperatures up to 350° or air containing acids and alkalies without danger of premature failure of the belt or bearings. Other models operate efficiently against pressures as high as 10" water gauge.

HARTZELL

Please send me details on
☐ Hartzell Duct Fans ☐ Vaneaxial Blowers
☐ The new Bi-Pass Duct Fan

Name _____

Company _____

Street & Number _____

City & State _____

If student, check here for special information ☐

propeller fan co.

Div. of Castle Hills Corp.

303 Herrman Avenue

PIQUA, OHIO

PROPELLER-TYPE FANS • BLOWERS
ROOF VENTILATORS • UNIT HEATERS

ENGINEERING OFFICES IN PRINCIPAL CITIES

The New York Coliseum, New York City. Owners: Triborough Bridge & Tunnel Authority. Architects: Leon & Lionel Levy. Mechanical Engineers: Guy B. Panero Engineers. Heating Contractors: Almirall & Co., Inc.

New $35,000,000 Coliseum where the best is a must!

depends on Sarco Heating Specialties

LARGEST AND MOST modern exhibition building in the world—that's New York's new Coliseum!

The 9 acres of exhibition space accommodates four expositions at one time. Each day, on the average, over 25,000 people visit the shows.

With a $35,000,000 investment at stake...with uninterrupted service to exhibitors of vital importance...no chances could be taken with equipment that might cause shut-downs!

Unfailing record of dependability... that's one of the reasons Sarco Specialties, for low-pressure heating and air conditioning systems, are installed in this world's largest exhibition hall... where dependability is "a must."

For undivided responsibility on your installations, it pays to specify and order from one "Complete Line" source ...SARCO-SARCOTHERM.

Write for catalogs to Sarco Company, Inc., Empire State Bldg., New York 1, N. Y.

Sarco Dependability... proved by many repeat orders from America's leaders

- Aluminum Co. of America
- Bethlehem Steel Co.
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- Western Electric Company

2186-B

SARCO

AN AFFILIATE OF SARCOTHERM CONTROLS, INC.

Steam Traps... Temperature Controllers... Heating Specialties

Weather-Compensated control systems for steam, hot water and radiant heating

The eight-story building is constructed on a framework of steel and reinforced concrete. The base is black St. Cloud granite, with the upper stories of cream-colored Minnesota Kasota stone.

Architect—Ellerbe and Company, St. Paul, Minn.
Contractor—The Baumeister Construction Company, St. Paul, Minn.
Heating Contractor—Hankee Heating Company, St. Paul, Minn.

BEAUTIFULLY EFFICIENT... EFFICIENTLY BEAUTIFUL...

Minnesota Mutual Life Insurance Company's gleaming new Home Office Building is the result of the combined efforts of the company's planners, the architects and the builders to couple modern beauty with top efficiency. It is said the now-completed structure is the most efficient physical plant that could be designed for the complex operations of this growing organization.

A significant phase in the effort to obtain the utmost in efficiency and dependability was the installation of USS NATIONAL Steel Pipe for the hot water heating and snow melting systems of the handsome new structure. Over 7000 feet of ¾-inch NATIONAL Pipe were used in the snow melting system, alone.

The consistent selection of NATIONAL Steel Pipe for the "big jobs" is nothing new. For over 60 years NATIONAL has been the accepted pipe for plumbing and heating systems. Regardless of the application, architects, builders and contractors know from long experience that they can put their complete confidence in the uniform, dependable performance of NATIONAL Pipe. Plan on using America's Standard Wrought Pipe in your next installation.

The snow melting system being installed. All ¾-inch lines and 2-inch headers were of NATIONAL Steel Pipe.

NATIONAL TUBE DIVISION, UNITED STATES STEEL CORPORATION, PITTSBURGH, PA.
COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO, PACIFIC COAST DISTRIBUTORS
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

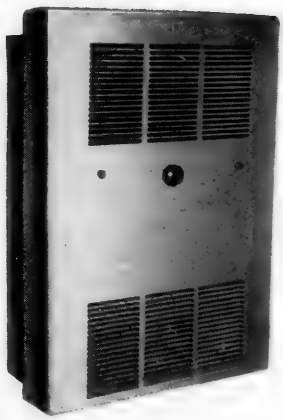
USS

NATIONAL PIPE

UNITED STATES STEEL

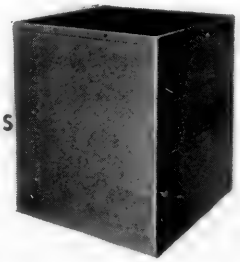
QUALITY
has no substitute

Use KRITZER
heating and cooling equipment for profit and top performance



DUAL-VECTOR®

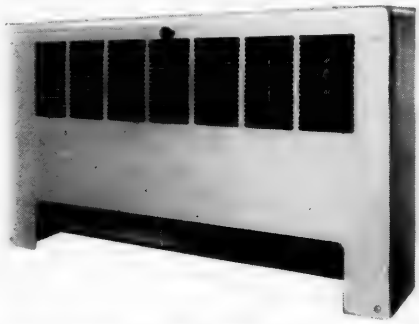
Low cost, combination heating and cooling units for residences, apartments and motels. Two models fit between studding. Easy installation. Clean, filtered air both summer and winter. Insulated enclosures prevent condensation. Individual room control optional. Free-standing types for remodeling.



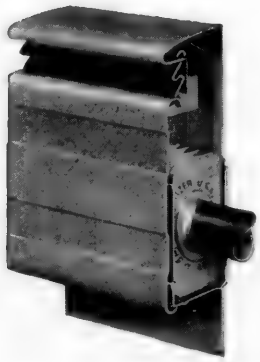
HYDRO-PAC® WATER CHILLERS

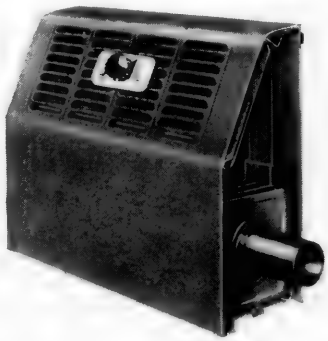
Completely packaged. Factory tested. Ready for easy field installation. Fine "furniture" steel cabinets with baked enamel finish. Five year warranty on hermetic system.

UNIT HEATERS Horizontal and vertical discharge, propeller fan types. Wide selection of sizes for steam and hot water. Die formed cabinets of heavy gauge steel. Baked-on, gray hammer enamel finish. Rubber mounted motors. Dynamically balanced fans in deep drawn venturi for quiet operation.



CONVECTOR-RADIATORS Floor, wall hung and recessed models. Famous KRITZER coil construction for steam and hot water. Bronze headers. Heavy, reinforced steel cabinets. Full range of sizes. Chain or knob operated dampers. Cabinets phosphatized. Gray prime, baked-on finish.





TYPE "R" AIR BASE WARM AIR BASEBOARD

Adds beauty to any home. Efficient warm air heating or cooling. Two and four foot lengths. Built to last.

"K" LINE RADIANT BASEBOARD

Clean, modern lines. Quiet. Easy to install. For homes, apartments, offices.

STB RADIANT BASEBOARD

For hard-to-heat areas. Large heating capacity. Safe, rounded corners and edges.

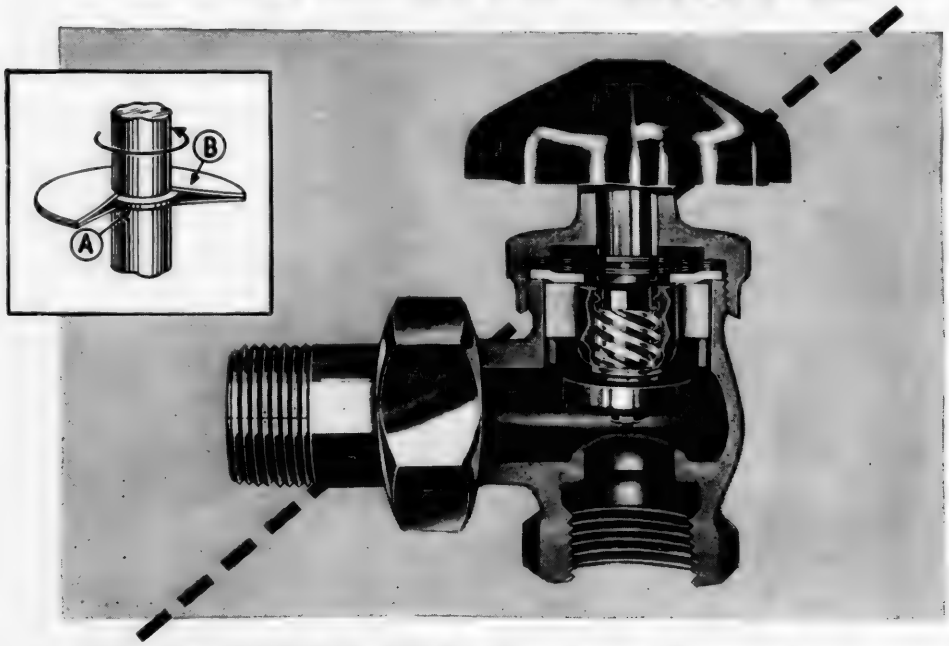
ASK YOUR JOBBER FOR KRITZER PRODUCTS

"IF IT'S KRITZER, IT'S RIGHT, SIR!"

KRITZER RADIANT COILS, INC.
2901 Lawrence Ave. • Chicago 25

KRITZER

A Valve that is



PACKLESS in fact

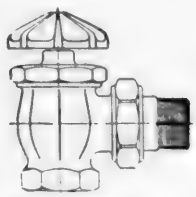
. . . *not just packless in name*

When the job calls for the kind of valve that will stand up across the years —when it calls for a valve that is packless in the full meaning of the word— then, no matter how far you look, you'll find in the Marsh Packless the only valve that completely fills the bill.

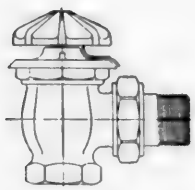
In fact, many users consider this the only valve that is packless in fact as well as in name, and they have a good reason for this. There is a difference between pack less and packless! The diagram tells the story of Marsh truly packless construction. A collar (A) is machined on the valve stem. The stainless spring steel wafers (B) press against this collar to form a tight annular seal This, you see, is a metal-to-metal seal—*permanently* leakproof.

And this better construction is typical of the quality and refinement found throughout the Marsh Packless Valve—in the swivel, self-seating, self-cleaning disc—in the excellent proportioning, machining, workmanship and finish.

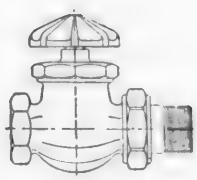
Packed valves can and do "blow out", scalding or burning the operator. This danger is avoided when you use the Marsh Packless. It is a valve you can rely on for any service up to 100 lbs. Furnished in a wide range of patterns including graduated and extended stem types, the Marsh Packless Valve is widely used for steam and hot water heating systems, coffee urns, steam kettles, sterilizers, ovens and similar services. Ask our representative or engineering department for facts.



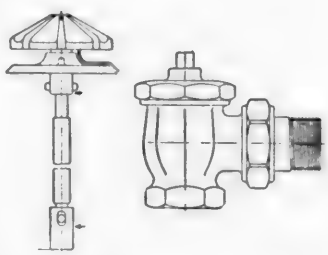
Wheel Angle



Wheel Angle Graduated



Globe



Extension stem

MARSH HEATING EQUIPMENT CO. *Sales affiliate of Jas. P. Marsh Corporation*

Dept. U, Skokie, Ill. Marsh Instrument & Valve Co. (Canada) Ltd., 8407 103rd St., Edmonton, Alberta

MANUFACTURERS OF GAUGES • THERMOMETERS • WATER REGULATING VALVES • SOLENOID VALVES

MARSH SINCE 1865

Quality Heating Specialties

Fits like a glove

PETRO firing unit with everything built in, balanced and factory tested

Phantomed area shows the Petro package unit (assembled at factory on its own base) fitted to boiler front. Refractory burner throat is part of the burner.

The PETRO package includes an oil or gas burner *(or combined gas-oil)*; a factory-wired control panel; forced draft air supply and a built-in fuel system—ALL IN A SINGLE INTEGRATED UNIT

This is not a simple conversion burner—it's a complete combustion system. Everything that goes into an ultra-modern firing system is right here, mounted on a rigid steel frame and ready to go. All of the intricate wiring and electrical controls are factory assembled, installed, and tested. Every component is engineered for the job, in the proper size, capacity, and type. Nothing is left to on-the-job improvising.

And best of all from *your* standpoint, a single unit means single responsibility. It's a Petro job from beginning to end and Petro is proud to back it up. It has all the sturdy qualities that have made Petro famous for DEPENDABILITY.

The Petro forced draft burner is suitable for firing all types of boilers, or can be purchased as a complete boiler-burner unit with matched Scotch type Titusville or Kewanee boiler.

Coupon will bring full information and specifications.

PETRO

T.M. REG. U.S. PAT. OFF.

PETRO, 3225 W. 106th Street, Cleveland 11, Ohio.
In Canada, write to 80 Ward Street, Toronto, Ontario.

Please send me literature and specification sheets on the money-saving Petro Package Unit.

Name_____

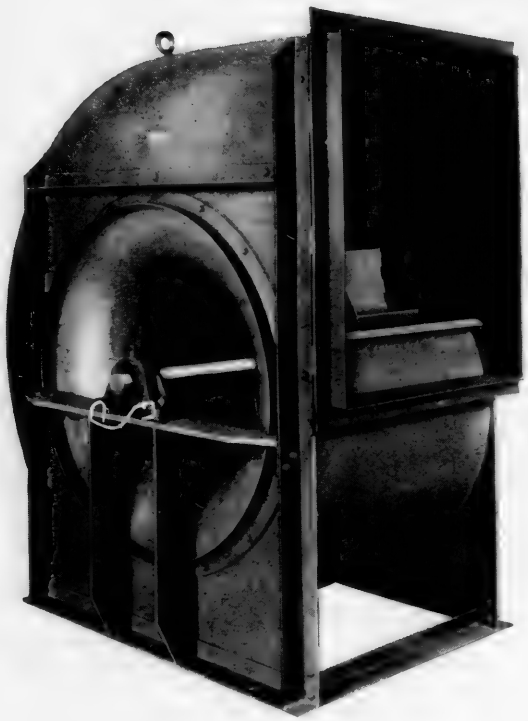
Company_____

Address_____

City_____ State_____

nyb centrifugal fans...

STANDARD AND HEAVY DUTY



Skillfully Engineered, Accurately Rated, Feature Heavy Welded Steel Construction

Two types of fan wheels. Housing dimensions remain the same but performance characteristics differ.

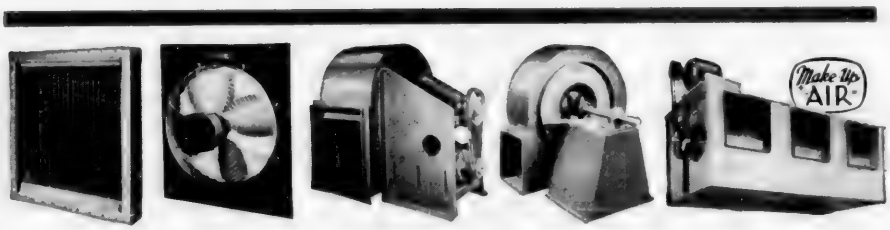
Forward Curve wheels offered from 7½ to 73 inch. Capacities up to 70,000 cfm.

Quiet operating, medium speed (IPL) wheels with non-overloading horsepower characteristics for heating, ventilating and air conditioning or industrial applications. Wheel diameters from 15 inch to 73 inch, with any speed or discharge required. Capacities up to 123,000 cfm. Class I, II, or III construction.

All-welded housing featured as standard construction for simplicity, extra strength and rigidity—dust tight and leak proof. Bolted (knock-down) type available in Class I and Class II. Split housing can be furnished as extra if required.

Write for Bulletins 544 and 561

nyb products have 65 years of manufacturing experience and engineering knowledge built into them. All ***nyb*** products are laboratory tested, accurately rated and fully guaranteed in strict accordance with standard test codes.

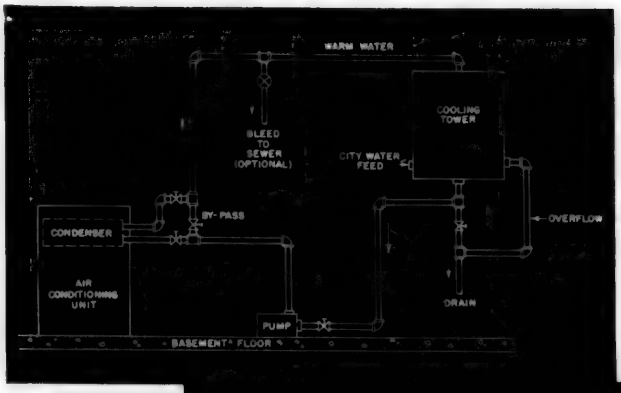


When working on your air handling problems, consult the *nyb* representative nearest you in our nationwide service or write for bulletins.

nyb **THE NEW YORK BLOWER COMPANY**

SALES OFFICES • 3165 SOUTH SHIELDS AVENUE • CHICAGO 16

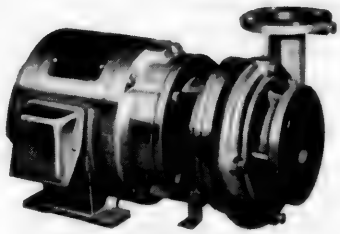
FACTORY, LAPORTE, INDIANA



QUIETER PUMPS

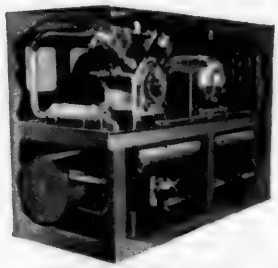
FOR COOLING TOWER APPLICATIONS

B&G 1522 CENTRIFUGAL PUMPS



B&G SERIES 1531-B CENTRIFUGAL PUMPS

Featuring vertical split case design...self-lubricating, leak-proof "Remite" mechanical seal ...latest NEMA motors. Superfinished shaft oversized for minimum deflection. Impeller is of sound hydraulic design, with balancing ring and relief holes to reduce thrust. Capacities to 1200 GPM, heads to 420 ft. Many sizes carried in factory stock.



B&G PACKAGE LIQUID COOLER

A complete cooling unit for homes, apartments, commercial and industrial buildings. Low pressure drop through evaporator—non-recycling pump down—integrated electrical control system—complete wiring—are a few of many outstanding features. Send for Bulletin HB-755.

Get rid of pump noise troubles in your cooling installations ...next time install a B&G 1522!

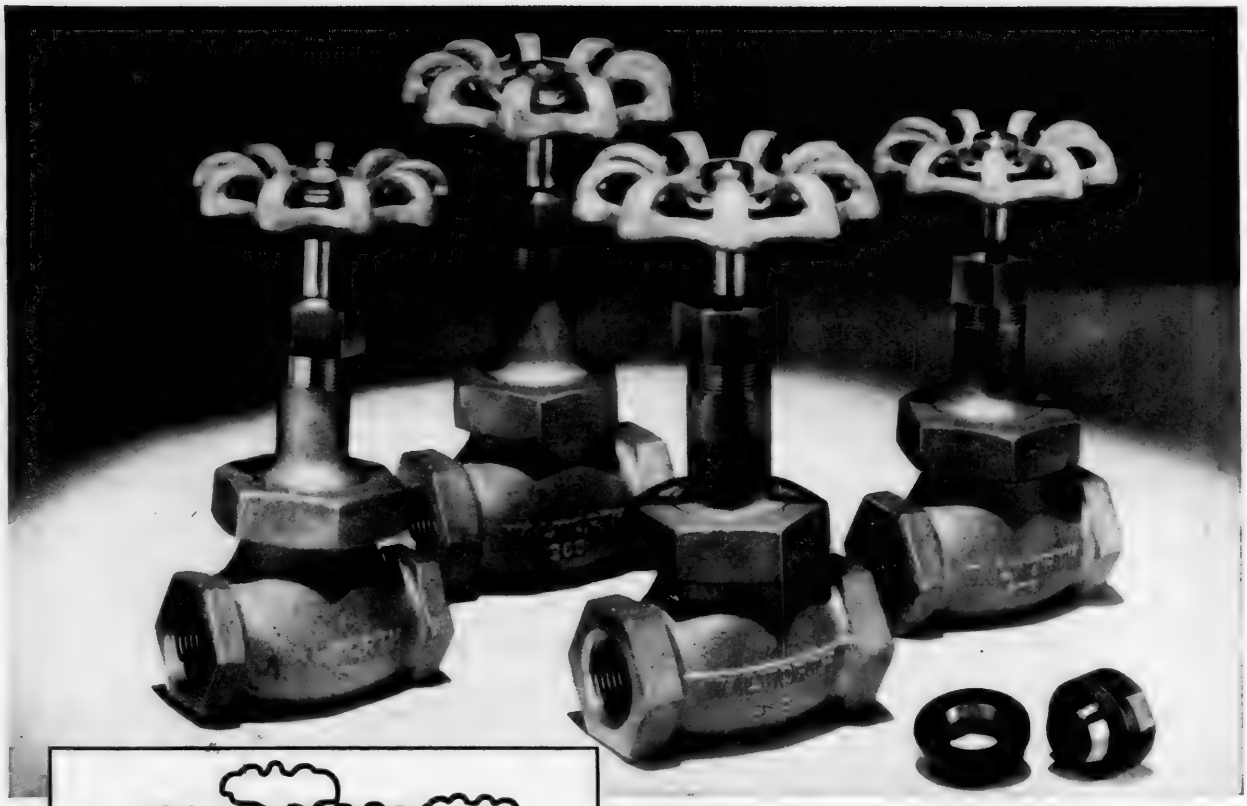
This pump is *really quiet*...because *both pump and motor* are equipped with long bronze sleeve bearings...and because of the noise-dampening flexible spring-type coupler.

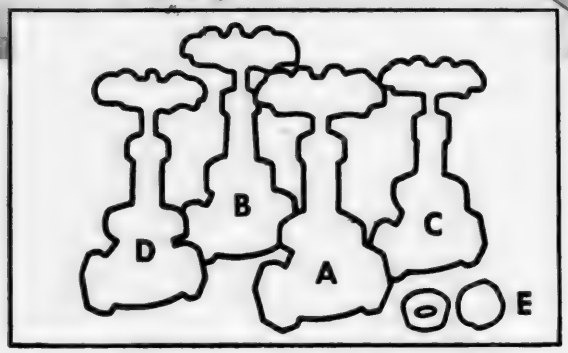
The B&G 1522 offers an impressive number of other features for dependable, low-cost operation. The "Remite" Mechanical Seal, for example, ends leakage troubles. It's self-lubricating—harder than glass—wear-proof. The impeller is dynamically balanced for smooth, vibrationless operation... the entire bearing bracket assembly, including shaft and sleeve bearing, is interchangeable. Servicing is simple—the 1522 separates into three parts.

All these plus values cost no more—the B&G 1522 Pump is *competitively priced!* It is available as an all-iron, bronze-fitted, all-bronze or a stainless steel unit, with capacities to 150 GPM, heads to 115 ft. Available in common sizes from factory stock. Send for Catalog.

Send for your free copy of the B&G Six Step Manual for Designing Cooling Tower Systems.

BELL & GOSSETT
COMPANY
Dept. REN-4 Morton Grove, Illinois
Canadian Licensee: S. A. Armstrong Ltd., 1400 O'Connor Drive, W. Toronto





A — No. 225P. . . . . 350 WSP 550F, 1000 WOG
B — No. 260P. . . . . 300 WSP 550F, 600 WOG
C — No. 245P. . . . . 200 WSP 550F, 400 WOG
D — No. 237P. . . . . 150 WSP 500F, 300 WOG
E — "500 Brinell" Stainless Steel Plug Type Seat and Disc

Walworth offers four lines of Bronze Globe Valves with stainless steel, plug-type seats and discs. Advantages of these valves include:

• **Stainless Steel Plug-Type Seats and Discs,** heat-treated to a minimum of 500 Brinell hardness reduces wire-drawing to a minimum. Seats and Discs are machined and fitted simultaneously, assuring perfect mating.

• **Deep Stuffing Boxes with Glands** are fitted with reinforced, molded packing. Valves can be repacked under pressure when fully opened.

For Longer Bronze Valve Life . . .

"500 BRINELL" PLUG-TYPE STAINLESS STEEL SEATS AND DISCS

150 lb. 200 lb. 300 lb. 350 lb.

• **Oversize Stems,** made of high tensile strength silicon-bronze, assure long life.

• **Rugged Body Hexes,** are flat on top; do not interfere with wrench gripping body-to-bonnet union ring connection.

• **Bodies,** made of Composition M bronze (ASTM B61), have ample wall thickness to provide high safety factor.

• **Patented Handwheels** are air-cooled and designed with a "finger-fit grip." Makes turning easy even when wearing greasy gloves.

• **Identification Plates** secured by lock-washer under stem nut, show Figure Number of valves and make re-ordering sure and easy.

FOR COMPLETE INFORMATION, SEE YOUR WALWORTH DISTRIBUTOR OR WRITE FOR ILLUSTRATED CIRCULAR

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Next, you forget about drilling, welding or riveting. With UNISTRUT, you simply cut the channel to length...slip the UNISTRUT nut in the channel slot...and tighten with a wrench. That's it!

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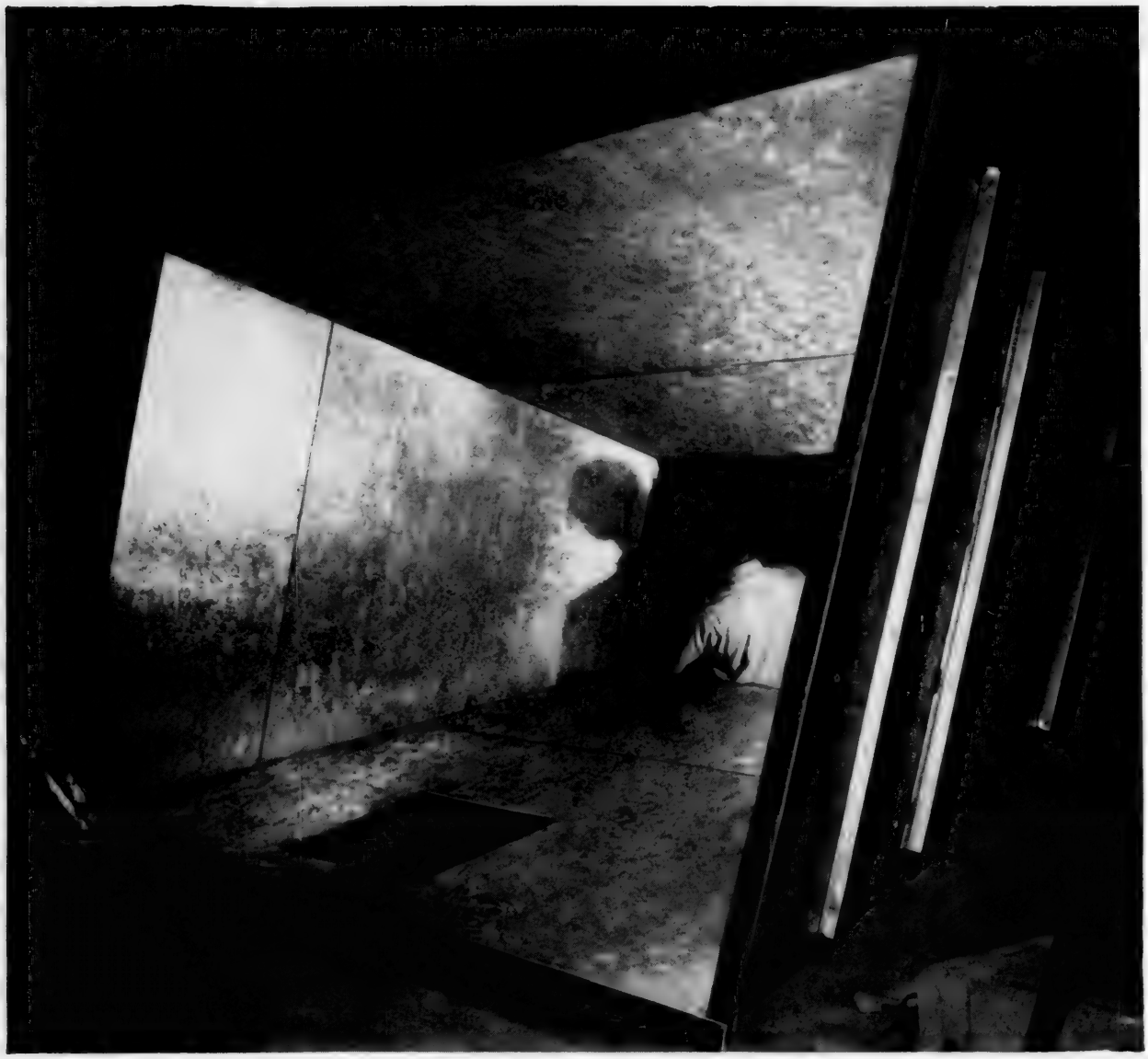


How Bethcon helps you do better sheet-metal work

Here we see part of the complex heating and ventilating system of a large department store in New Jersey. Tons of Bethcon galvanized sheets went into the fabrication of this system and contributed substantially to the quality of the installation.

You can do better sheet-metal work with Bethcon because Bethcon sheets are made by a continuous process of galvanizing, which binds the zinc coating more tightly to the steel than the conventional method. This extra-tight coating permits severe forming without danger of cracking or flaking off.

You will find, in addition, that Bethcon has brighter, more uniform spangles which present a more attractive appearance. And the zinc is distributed more uniformly over the entire sheet, thus eliminating the bead normally found on the drip end.

If you have not yet worked with Bethcon galvanized sheets a chat with someone who has should prove interesting to you. We will be glad to give you the name of such a contractor in your vicinity. And, of course, we are ready at any time to discuss Bethcon with you ourselves. Just call or write to the nearest Bethlehem sales office.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. *Export Distributor:* Bethlehem Steel Export Corporation

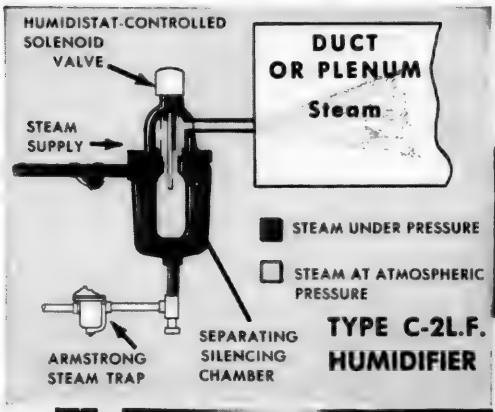
BETHLEHEM STEEL

BETHLEHEM STEEL

a Practical Answer to Central Humidification

. . . ARMSTRONG STEAM HUMIDIFIERS

• Automatic Control • No Dripping
• No Sludge or Scale



Low Cost . . . Low Maintenance

Armstrong Steam Humidifiers, connected to discharge into ducts or plenum chambers, provide automatic, low cost, trouble-free central humidification.

They are ideally suited to original installations, and also have been widely used to replace troublesome, old-fashioned pan and steam coil or perforated steam pipe humidifiers.

Their low maintenance is highly regarded by users. Gone are the problems of drilling out scaled-up pipes or cleaning sludge and scale from pans and coils.

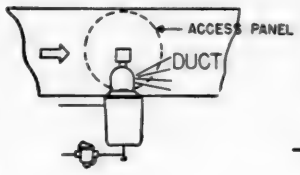
There is no dripping. Control is accurate (within 2% to 4% of humidistat setting). There is no problem of condensation. Installation is simple. Servicing is simple and infrequent. Valves and glass wound solenoid coils last indefinitely. Armstrong Humidifiers are unconditionally guaranteed to satisfy.

Three sizes are available with capacities ranging from 25 to 1280 lbs. of steam per hour. Air-controlled models also are available.

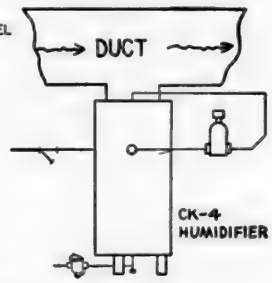
For complete selection, installation and price data, call your local Armstrong Factory Representative, or write:

ARMSTRONG MACHINE WORKS
846 Maple St., Three Rivers, Michigan

Type CK-4 Humidifier discharging into space heater.



Type C-2L.F. Humidifier installed with discharge outlet inside duct. These units can also be installed outside duct with pipe from outlet connected into duct.



Type CK-4 installed below large duct. Can also be installed horizontally.

ARMSTRONG STEAM HUMIDIFIERS

WHAT KIND OF A BUYER ARE YOU?

If you buy air filters on PRICE

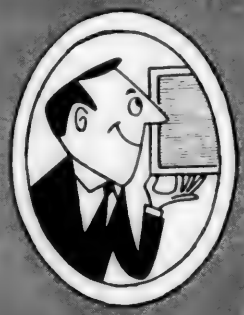
consider this:

FAR-AIR filters will save you enough over "cheap brands" to pay for your original filter investment many times over. You get reasonable first cost... and lower maintenance costs for many years.

If you buy air filters on PERFORMANCE

consider this:

FAR-AIR filters handle more air with greater efficiency and less pressure loss. When you select the filter you need from the FAR-AIR line, you are assured of getting the most practical solution for your particular dust problem.



If you buy air filters on QUALITY

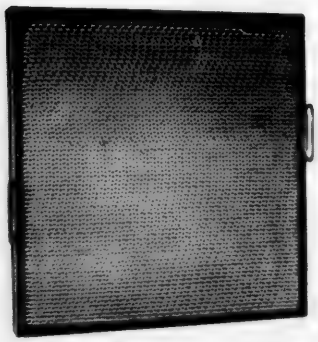
consider this:

FAR-AIR filters are built up to a standard, not down to a price. There is no compromise on quality materials, features or workmanship. FAR-AIR filters invite comparison.

If you are from "MISSOURI"

consider this:

Farr field engineers, by actual tests on *your* filter bank under *your* operating conditions, will prove to *your* satisfaction that FAR-AIR filters will give better performance *and* save you money. We make no casual claims — only request the opportunity to *prove* our points.



So, no matter how you buy, you'll find it good business to buy FAR-AIR. We can show you specific cases in practically any part of the country, and on almost every kind of application, where FAR-AIR products are doing a better job at a lower cost.
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AIRCOUSTAT SILENCES ALL FREQUENCIES IN THE AUDIO-FREQUENCY RANGE!
Resonators hold low-frequency sounds
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AIRCOUSTAT* Sound Traps eliminate air conditioning noise at 50% less cost

Acoustical Performance Guaranteed. Easy to Install. Pre-Engineered — No Design or Layout Headaches.

Revolutionary AIRCOUSTAT Sound Traps require no special tools for installation . . . reduce your labor costs and lower your installation time. Units fit any size or shape of duct. If AIRCOUSTAT fits *geometrically*, it fits *acoustically*.

AIRCOUSTAT is the most efficient method of sound-deadening you can provide your customers. A 7-foot AIRCOUSTAT unit suppresses as much sound as 100 feet of ordinary duct lining. AIRCOUSTAT eliminates all frequencies in the entire audio-frequency range, silences entire systems or selected outlets. Flow resistance and pressure drop are lower. 4 series cover applications ranging from general offices to recording studios.

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*Koppers Trade Mark

KOPPERS **INDUSTRIAL SOUND CONTROL**

Engineered* Products Sold with *Service

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Gentlemen: Please send me a free copy of your booklet on AIRCOUSTAT Sound Traps.

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Company.....

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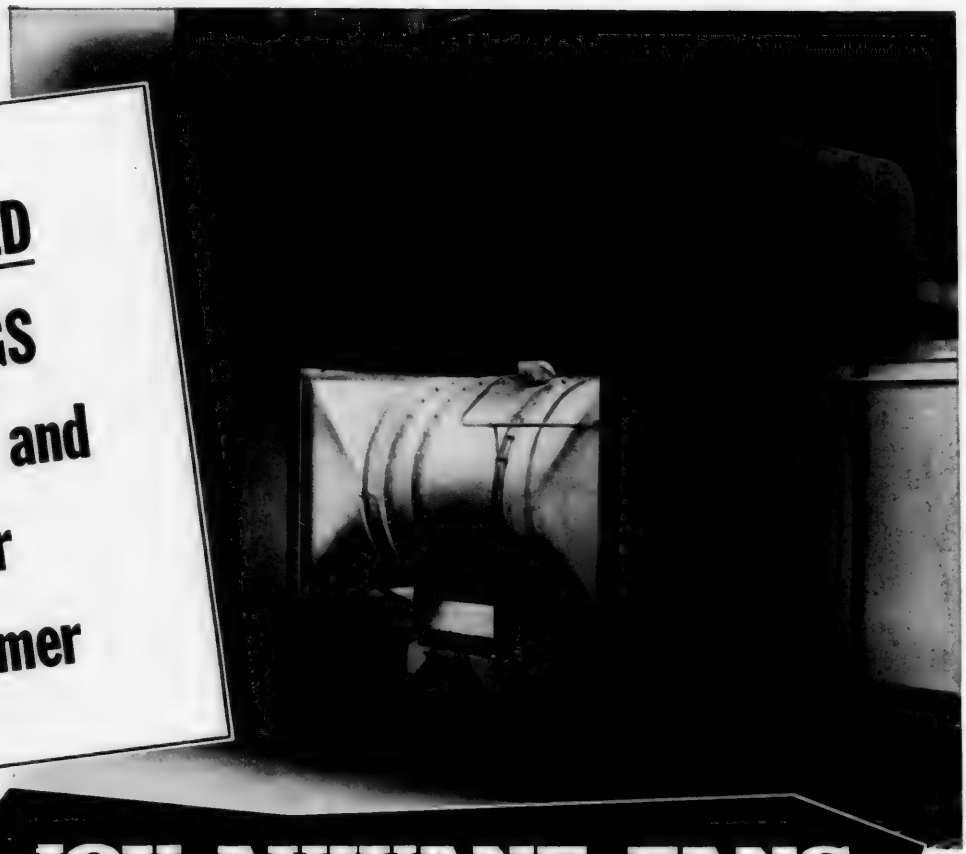
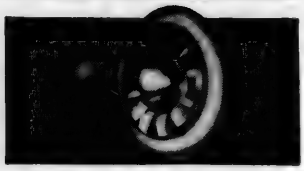
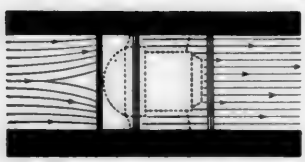
City..... Zone..... State.....

PLANNED SAVINGS for you and your customer



with JOY AXIVANE FANS





SAVE POWER The unique vaneaxial design utilizes aerodynamic blades with close tip tolerance. Internal vanes recover the rotative energy of the air from the blades and convert that energy to velocity and pressure. Result: high performance at low cost.

SAVE SPACE In-line design permits installation right *in the duct.* The photograph above, at Minneapolis-Honeywell Company, illustrates this feature. The fan, which supplies air to two large floors, utilizes an area only 54" in diameter and 26½" long. Result: exceptional economy of space.

SAVE INSTALLATION COSTS In-the-duct mounting of Joy Axivane Fans is easily and quickly accomplished, and requires only the simplest supports. Result: reduced labor time and costs.

Thus, the remarkable efficiency of the Joy Axivane Fan design . . . in contrast with other air-moving machines . . . gives you great savings in power, space, and labor. . . . And remember, the bigger the job, the greater the margin of benefit you enjoy. For full details, write ***Joy Manufacturing Company, Oliver Building, Pittsburgh 22, Pa.*** In Canada: *Joy Manufacturing Company (Canada) Limited, Galt, Ontario.*

Write for FREE Bulletin 55-40

Consult a Joy Engineer

for VANEAXIAL FANS • COMPRESSORS • OXYGEN GENERATORS
VACUUM PUMPS AND BOOSTERS

WSW 15856-55

JOY

WORLD'S LARGEST MANUFACTURER OF VANEAXIAL-TYPE FANS

SKIDMORE PUMPS have set a standard for performance and dependability since 1921

SPECIFY WITH CONFIDENCE

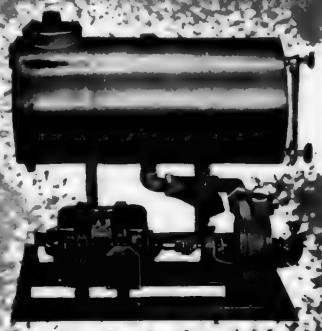
There's a Skidmore Pump designed for each and every heating requirement. *Write for bulletins*

TYPE "CVS"

New, wider range of discharge pressures—from 10 to 40 lbs. Capacities range from 500 to 10,000 sq. ft. E.D.R.

TYPE "TM"

Completely assembled on either steel or cast iron base—capacities, for boiler up to 250 H.P., with discharge pressures to 150 lbs.

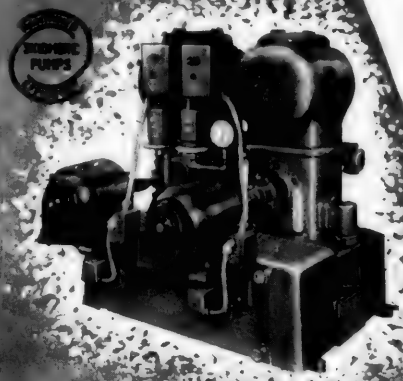


TYPE "HS"

Sturdily constructed for dependable service at small investment—capacities, 1,000 to 65,000 sq. ft. E.D.R., discharge pressures from 10 to 75 lbs.

VACUUM TYPE

Automatically adjusts itself to the varying conditions of the system. Efficiency maintained. Capacities ranging from 5,000 to 100,000 sq. ft. E.D.R.



TYPE "UV"

Designed for low return installations—capacities, 2,000 to 40,000 sq. ft. E.D.R. and discharge pressures from 10 to 75 lbs.

Send Coupon For Bulletins

SKIDMORE CORPORATION
ST. JOSEPH, MICH.

SKIDMORE CORPORATION, ST. JOSEPH 11, MICHIGAN

Please send bulletins on the following (pumps checked below).

CVS TM HS UV VACUUM

Name .....

Firm .....

Address .....

City ..... State .....

INSTANT PROTECTION...

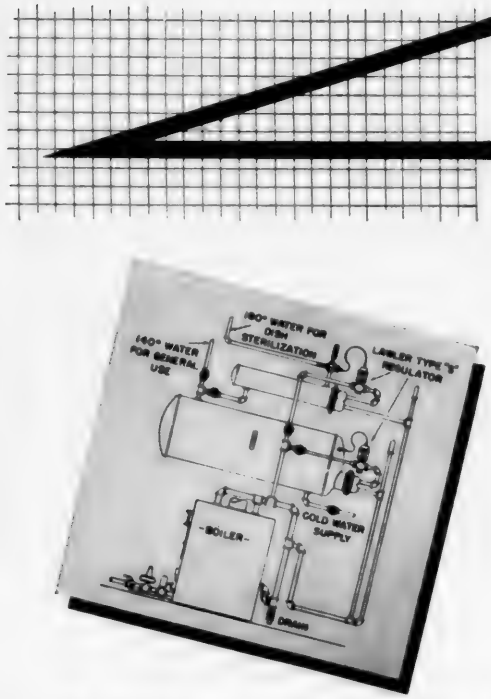
PRECISION CONTROL!

LAWLER TYPE "S" TEMPERATURE REGULATOR

DIRECT ACTING — Accurately controls all steam heating equipment. Protects against over heating...a rise in temperature above setting closes valve.

REVERSE ACTING — For cooling systems and recirculating lines. Rising temperature opens valve...drop in temperature causes valve to close.

THREE WAY — Mixes hot and cold liquids . . . delivers them at a constant pre-determined temperature.



ONE DEGREE OFF — up or down, and the Lawler Type "S" Temperature Regulator is in action . . . correcting to and maintaining the desired temperature.

Hydraulically formed bellows are non-ferrous, give "hair-line" control with instant response. Highly polished stainless steel valve stem provides friction-free operation for real rugged performance . . . longer lasting durability.

There's no job too tough . . . too unique for the Type "S". It's available in many variations for any special purpose. In industry, dairies, food processing, Diesel engineering . . . where ever steam, gases or fluids are used, the Lawler Type "S" Temperature Regulator will do an excellent control job for your customer.

THE *Lawler* **Line of Thermostatic Control Valves**

ERFORMANCE TESTED FOR LONGER LIFE

Steam Temperature Regulators
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Water Controllers
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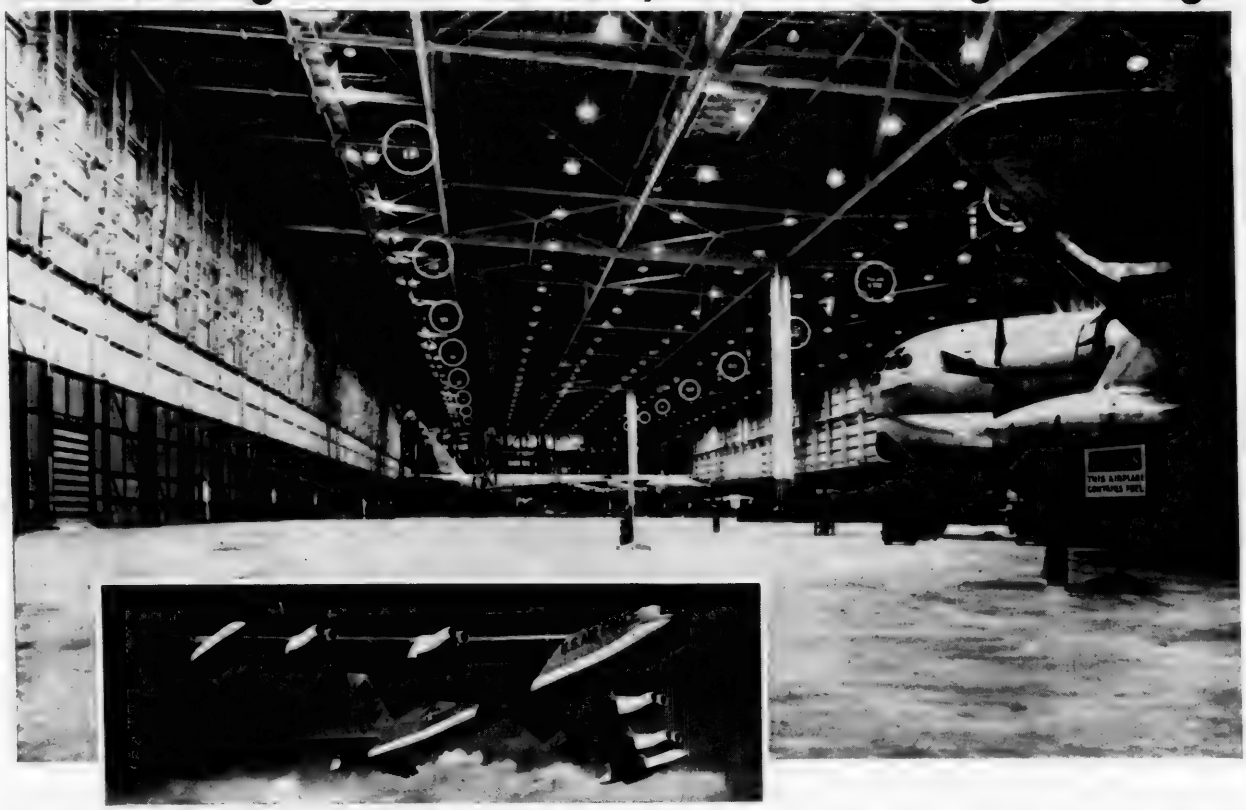
DESIGNERS AND PRODUCERS OF THERMOSTATICALLY OPERATED VALVES SINCE 1895

LAWLER AUTOMATIC CONTROLS, INC., MT. VERNON, N. Y.

Real Heating Comfort for Low, Medium or High Buildings



For the Hangar that houses the big B-52 Bombers

(It's 90 feet high and one-sixth of a mile long)

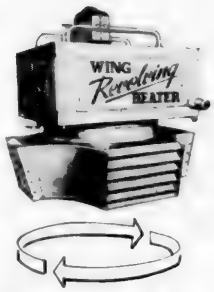
Boeing again chose "Wing Revolving" Heaters

Since their first installation in the 1940's, the Boeing Airplane Company of Seattle has installed "Wing Revolving" Heaters in many of its hangars and other manufacturing buildings. When the new Flight Test Hangar, 880 feet long by 200 feet wide and 90 feet high, was built to hold five giant B-52 Bombers at one time, "Wing Revolving" Heaters once again were selected to heat it.

Mounted high above the planes, the heaters project warm air downward from slowly revolving distributing outlets. The entire working area is covered with a blanket of warm air that moves around, over and under the widespread airplane wings.

"Wing Revolving" Heaters can be the answer to your heating problem, too, regardless of the height or area of the building. With "revolving heat" every worker is in the "comfort zone" for there are no steady hot blasts; no pockets of cold air. And, in summer, with heaters operating with steam turned off, the revolving distributors produce a pleasant cooling effect that keeps workers refreshed and more productive.

To get details send for Bulletin HR-6A.

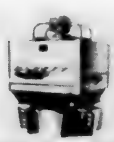


Four designs of revolving distributors are available. In the high hangar above, No. 10 design was used. At left is shown the No. 5 design for low buildings.

Wing
REVOLVING HEATERS

L. J. Wing Mfg. Co.

158 Vreeland Mills Rd., Linden, N.J.
Factories: Linden, N.J. and Montreal, Canada
In Europe: WANSON, Haren-Nord, Brussels, Belgium



WING FRESH AIR SUPPLY HEATERS

WING DRAFT INDUCERS

WING FANS

WING TURBINES

WING MOTORIZED BLOWERS

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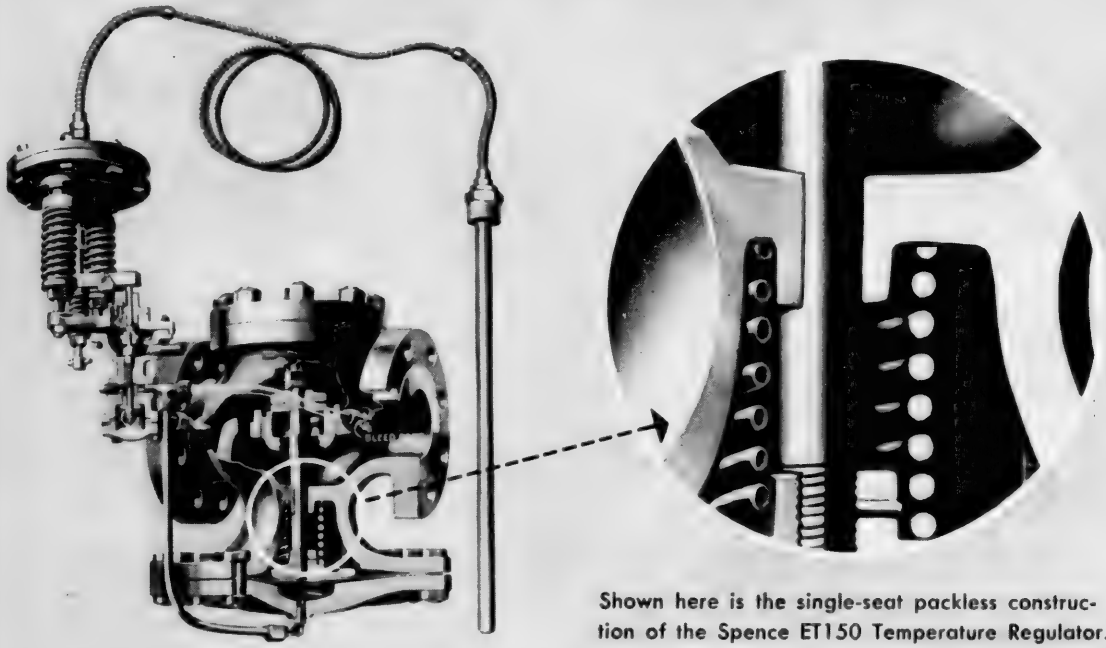
158 Vreeland Mills Rd., Linden, N.J.

Please send me Bulletin HR-6A—Revolving Heaters

Name.....
Firm.....
Address.....
City.....Zone.....State.....

Advantages of Packless Construction in Temperature Regulating Valves



Shown here is the single-seat packless construction of the Spence ET150 Temperature Regulator.

One of the biggest headaches in regulating valve maintenance is repacking stuffing boxes.

How often a valve needs repacking, how much time it takes, and the cost of the system downtime all vary with the construction of the regulator and the service it's used for. No matter how you calculate all these variables it's still a headache—and an expensive one.

In the temperature regulator shown above (Spence Type ET150) stuffing boxes are eliminated. This is done by what is known as "balanced" diaphragm construction. You can see in the cutaway drawing that pressure is applied to both sides of the large metal diaphragm. The upper side is exposed to delivery steam pressure and the lower side is exposed to loading pressure applied by the pilot. When the pilot closes, both delivery pressure and loading pressure are equalized through the bleedport and connecting tubing.

This construction not only does away with repacking problems, but it makes possible additional savings as well. For example, you will note in the sectional blow-up that this design eliminates a closely fitted stem and guide. Dirt or other foreign matter doesn't have much of a chance to lodge between these parts and cause sticking.

Another cause of binding or sticking, uneven expansion of closely fitted parts, is also eliminated with this design. In addition, valve stem wear is reduced for the same reason.

Lower maintenance is not the only advantage of this packless construction. Accuracy of regulation is also improved because friction due to a stuffing box, dirt, or uneven expansion is not a problem. The large, *balanced* metal diaphragm is more sensitive to slight changes in pressure.

Guaranteed Not To Wiredraw

If seats and discs are cut by steam (wiredrawn) the loss of steam through these grooves can be another expensive item — directly charged against the regulating valve. Fortunately, you can eliminate these costly leaks by specifying a temperature regulator that is *guaranteed not to wiredraw.*

Spence makes such a guarantee because their seats and discs are made of SECO Metal. Over 20 years experience with this special alloy has failed to produce a single case where a SECO Metal seat or disc had been cut by steam. All that's required is an approved strainer located ahead of the regulating valve. Expensive steam leaks just can't happen with this combination of SECO Metal and single-seat design.

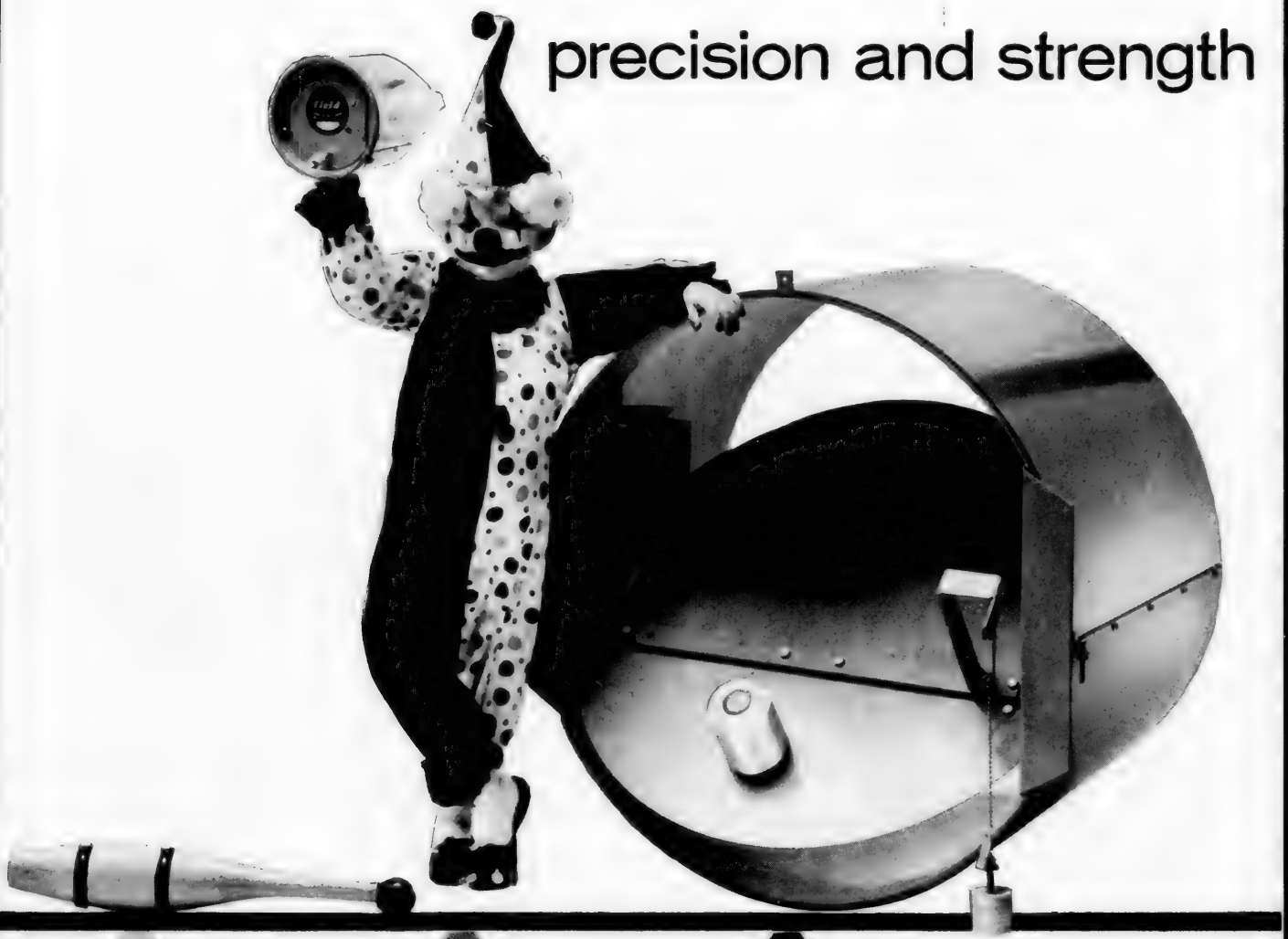
If you would like to have more information on Spence Temperature Regulators, drop us a line and ask for Bulletin T150. It gives more detailed information on these and other Spence design features. Piping layouts and helpful information on the installation of temperature regulators are also included. Write for your copy today.

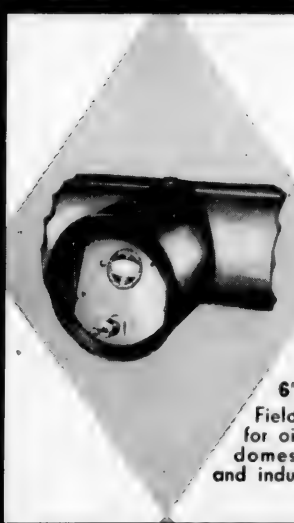
SPENCE ENGINEERING COMPANY, INC.
Walden, New York

SE 140

midget or GIANT

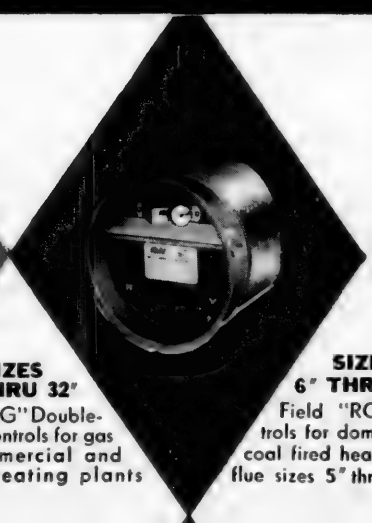
Field draft controls provide both precision and strength





SIZES 6" THRU 32"
Field "M" Controls for oil and coal fired domestic, commercial and industrial heating plants

SIZES 8" THRU 32"
Field "MG" Double-Acting Controls for gas fired commercial and industrial heating plants



SIZES 6" THRU 9"
Field "RC" Controls for domestic oil and coal fired heating plants, for flue sizes 5" through 10"

FIELD CONTROL DIVISION
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Field

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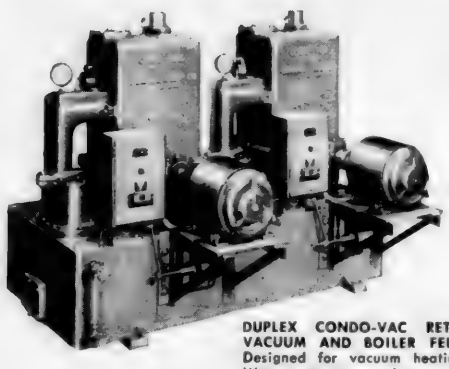
At left the TYPE AVC CONDENSATION PUMP & RECEIVER—Heavy cast iron receiver with low inlet for floor mounting or shallow pit. Cap. 500 to 10,000 EDR. Pressure 10-30 lbs.



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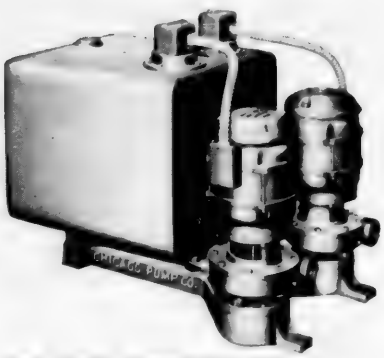

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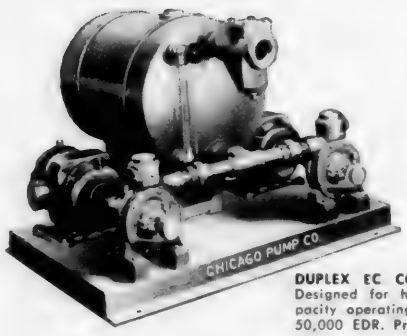
TYPE CLLI VERTICAL CONDENSATION PUMP & RECEIVER—Designed for low return service and underground installations. Cap. 1000 to 40,000 EDR. Pressures 10 to 25 lbs.



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They've written the story on the blackboard—two reasons why 95% of the steam traps in Elkhart, Ind. schools are Illinois. "Next day" delivery of traps and parts is a good reason for *anyone* to specify Illinois Engineering traps, but there are other reasons, especially if you're interested in long service and low maintenance costs.

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The yearly maintenance cost of Elkhart schools' Illinois traps averages only a few cents per trap. And the Illinois representative, Bill Ervin (right), is looking for ways to help Lantz cut that!

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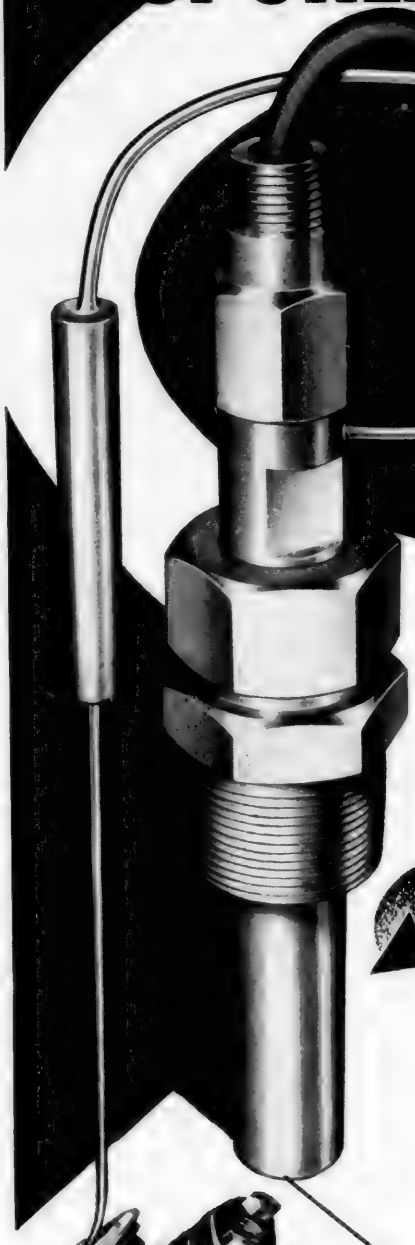

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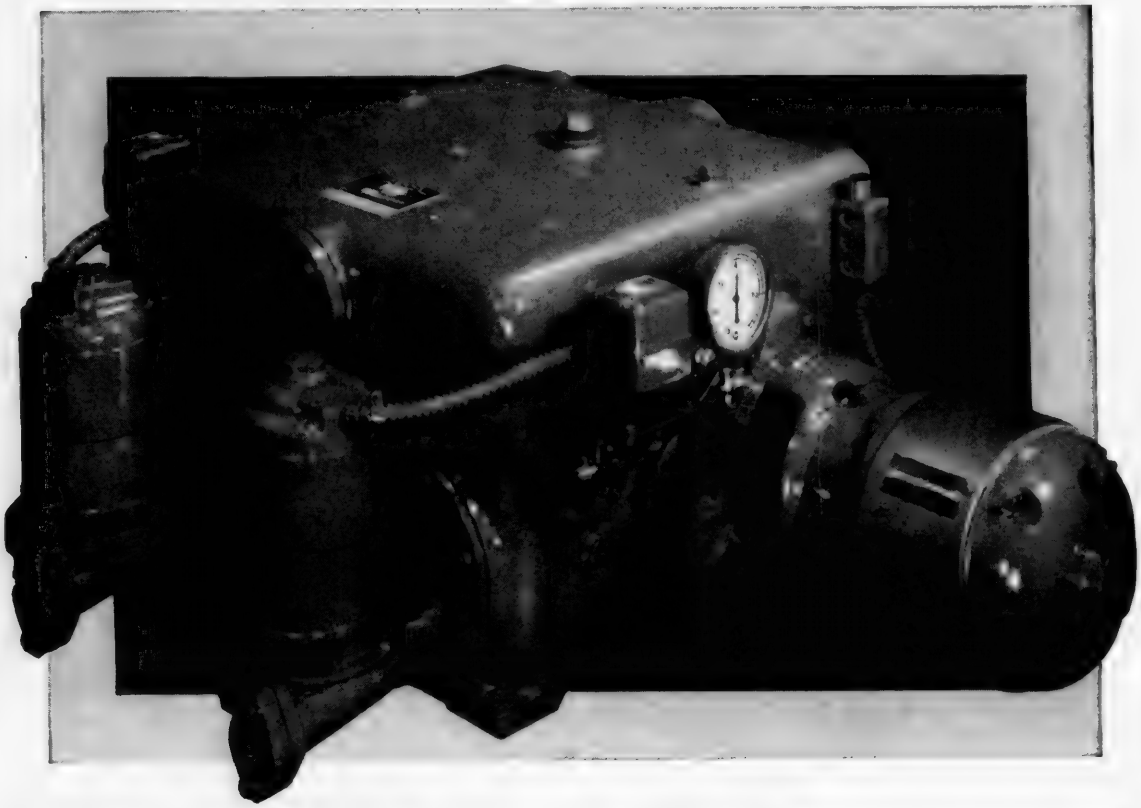

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These pumps possess many other features which permit a more efficient utilization of fuel and minimum use of electric power. Low, low returns reduce installation costs and usually eliminate putting the pump in a pit. Simplicity and efficient operation reduce supervision and maintenance costs. Information regarding this new heating pump development is available immediately upon request.

- Increased air capacity induces rapid system response without wasteful overheating.
- Separate air and water pumps individually selected to meet actual job requirements.
- Control system that operates individual pumps only when needed.
- Flexibility permitting addition of radiation without changing basic pump installation.
- Low, low, return line connection.

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MODERNIZING THE AIR CONDITIONING SYSTEM OF A DEPARTMENT STORE

JOSEPH H. JERRELL and IRWIN ISAACSON

On the Staff of Leo S. Weil and Walter B. Moses, Consulting Engineers, New Orleans, La.

A growing department store is eventually faced with expansion and modernization of its air conditioning system. Many design and installation problems have to be solved. What was done in modernizing the system of a large Cincinnati, Ohio, department store is described, and summaries presented to show how the design engineers arrived at decisions followed in this installation.

LIKE a boy grown too big for his britches, the physical plant of Shillito's, a department store in Cincinnati, Ohio, and the air conditioning system serving that store, have been straining at the seams to keep pace with the spectacular results of progressive merchandising.

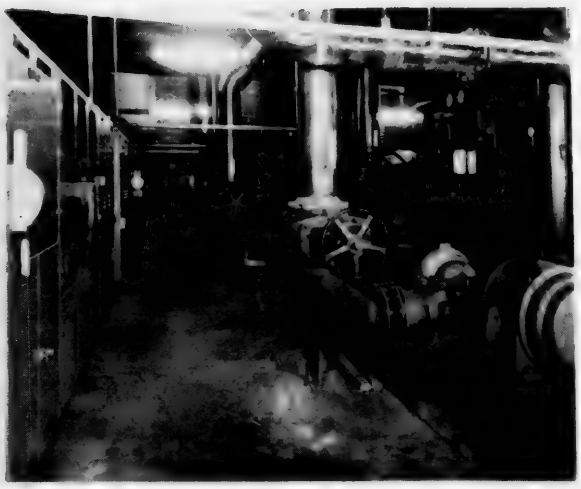
In 1954, Weil and Moses, consulting engineers, made a complete survey to determine the most economical and efficient method of modernization. Based upon the combined recommendations of the consulting engineers and the store's chief engineer, steps were taken to provide an adequate, modern air conditioning system, to replace the old system that had grown like Topsy.

Existing Conditions

The first equipment was installed in 1934 and additions were made as the store's requirements increased. The early equipment had been designed to maintain an inside temperature of 80 to 85 deg F, which is certainly considered too warm for present requirements. A total of eight reciprocating compressors were carrying the refrigeration load. These had been installed at various times as more air conditioning was required and were not part of any long-range plan. The age and operating condition of the machines made necessary constant repair and replacement work. In an attempt to maintain better conditions in the store, chilled water temperatures had been lowered from the original design conditions and this served to decrease (1) the operating capacity of the machines and (2) lower the efficiency of the plant. In order to help the refrigeration plant carry additional tonnage, chilled water temperatures were allowed to rise with the result of higher humidities in the store.

A large number of ceiling-mounted air handling units scattered throughout the store supplied the cooled air. The moderninzing program at the store and the demand for merchandising space made these units even more inaccessible than when originally installed. Because these units were so widely scattered and also inaccessible, maintenance was difficult and costly. Sales areas and displays were always subject to damage from overflowing drain pans, leaking fittings and removal of dirty filters.

The old piping system was also a source of trouble as most of it was over 20 years old and a great part of it concealed. Leaks had caused considerable damage in the



Interior view of machine room showing switchboard, condenser and chilled water pumps.

past and were a potential source of increased future trouble. The piping, like the rest of the system, was inadequate to handle the present cooling load.

Wells had been employed for condensing water. These wells could have been useful for both supplementary refrigeration and high efficiency operation of the compressors. However, the well water had the ability to cause rapid formation of scale and, furthermore, the water table had been gradually falling so that the wells were no longer a dependable source of supply. A further objection to the use of well water was the fact that the city has a heavy sewer tax on all water discharged into its sewers so that the store was paying heavily for this so-called "free" supply of water.

Results of Study

There were at least six reasons for modernizing the air conditioning system:

1. An increase in the conditioned areas.
2. Desire for lower temperatures and humidities.
3. Inaccessibility of air handling equipment.
4. Poor condition of chilled water piping.
5. Uncertainty of well water supply.
6. High cost of maintenance and repairs for entire system.

After the survey had been made and several conferences held between the consultants and the store personnel, it was agreed that the following steps would be taken to remedy the situation:

1. Provide an entirely new refrigeration plant.
2. Locate all machinery at a central point on the roof of the building.
3. Provide a cooling tower on the roof to replace the uncertain well water supply.
4. Utilize existing lateral supply ducts on each floor, wherever practical, and connect to new air distribution risers supplied from fans located in fan room on roof.

Equipment on Roof

The building roof was considered an ideal location for all equipment for a number of reasons.

1. It offered a large area for all the mechanical equipment without the sacrifice of any existing sales or stock space.

2. Consolidating all equipment in this manner results in a great reduction in operating crew and a considerable yearly saving both in operation and maintenance.

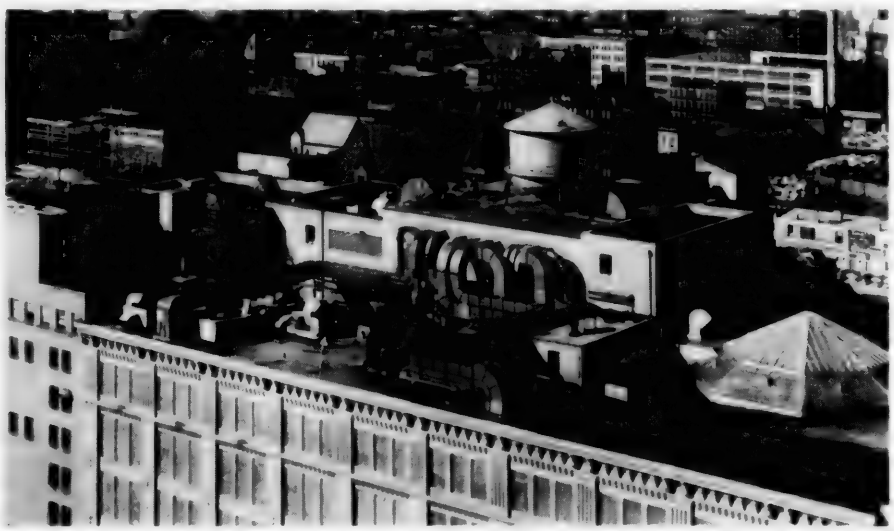
3. The installation of a centrifugal compressor in the existing sub-basement machine room was physically impossible because of limited head room. The roof location would not offer this obstacle.

4. An investigation showed that the existing buildings were structurally designed to support the load which would be imposed by the new mechanical equipment.

5. The cost of condenser water piping would be reduced to a minimum as the tower could be installed directly above the refrigeration plant.

6. The cost of chilled water piping would be relatively inexpensive and, furthermore, there would be no more danger of leaks anywhere in the store itself.

Roof of department store during construction. At left is a new machine room being constructed to house two 900-ton York refrigeration units, condenser and chilled water pumps. Over this a cooling tower is being erected.



7. Ventilation of the machine room was extremely simple, as the air could be drawn in and discharged directly on the roof.

From management's point of view, the roof location avoided use of additional sales space. Maintenance of machinery and equipment could be accomplished out of the occupied areas of the store.

There was an additional expense in locating equipment on the roof. This was the cost of running electrical service from the power company's transformer vaults in the basement, but, this cost was considerably less than the extra cost of condenser and chilled water piping had the equipment been placed scattered throughout the building.

Penthouses

One major expense incurred by the roof top location was the cost of housing and equipment. Two large penthouses were constructed—one for air handling equipment (fans, coils and filters) and a second for the refrigeration plant (centrifugal machines, chilled water pumps, condensing water pumps and electrical substations. These penthouses had to be well constructed to present a neat appearance and they added considerably to the cost of the air conditioning installation. However, they freed valuable sub-basement space formerly used for machinery and, as has already been pointed out, obviated the necessity of using existing sales space for equipment.

Refrigeration Systems Considered

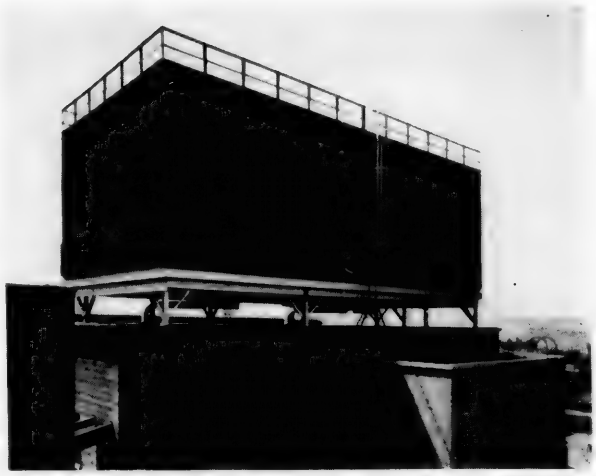
For the new refrigeration plant, three general types of systems were considered:

1. Absorption type refrigeration machines used in conjunction with back pressure turbine-driven pumps.
2. Steam-turbine driven refrigeration compressors used in conjunction with electric motor-driven auxiliaries.
3. Electric motor-driven centrifugal compressors and auxiliaries.

Detailed analysis of these three types of plants showed that the all-electrical system entailed not only the lowest initial investment but was also the cheapest in operating cost. For flexibility and economy of operation, it was decided to install two centrifugal compressors, each driven by a 900 hp motor, thereby providing a total capacity of approximately 1800 tons. The chilled water and condenser pumps were located in the machine room adjacent to the compressors. The cooling tower was erected directly above the machine room so that the cost of condenser piping and the pumping head were kept to a minimum. The machine room is only about 70 ft from the fan room, so that the cost of chilled water lines was also minimized.

Air Movement

An ideal space was found for the fan room under an elevated fire protection tank, the room being built around the tank supports. All supply fans, cooling and heating coils, dampers and filters were installed in this fan room. To facilitate cleaning, the chilled water coils were inclined at about a 45 deg angle instead of being set vertically. This helps the engineer to hose the dirt out of the coils into the drip pans below them and permits easy access to all equipment for efficient maintenance.



A 6500 gpm cooling tower with corrugated Transite casing.

After making studies of the comparative merits of various systems, it was decided to use the blow-through type of system. By this is meant that the mixture of return air and fresh air, after being drawn through the filters, is discharged by the fans through the heating and cooling coils, and face and bypass dampers, and then through a number of zoned risers to the conditioned areas. This system was selected instead of the more conventional design, in which the air is drawn through the coils to the fans, for the following reasons:

1. The 38 zones in the store would have required 38 separate draw-through fans, motors and drives. With the blow-through system, 6 large fans accomplished the same purpose.
2. Considerable saving in fan room construction and sheet metal resulted from use of the blow-through system.
3. Electrical wiring costs were lower because of the smaller number of fan motors.

An analysis was made to determine the optimum air velocity at which to distribute supply air from the fan room to the sales areas. Three general divisions of initial duct velocity were considered:

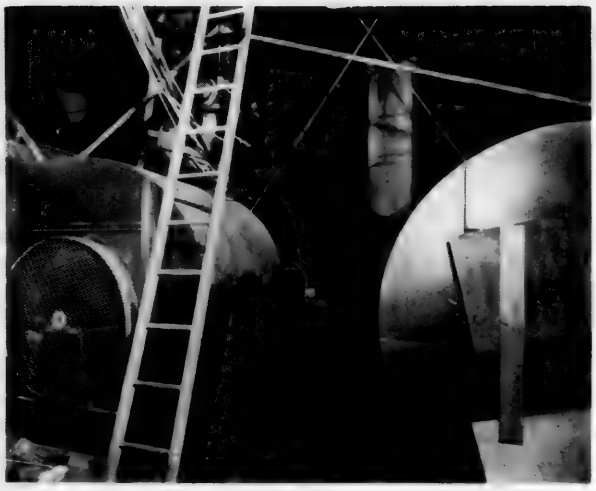
(a) Low velocity (1500 rpm)
(b) Medium velocity (3000 fpm)
(c) High velocity (6000 fpm)

Conventional low velocity distribution was eliminated because of the large space required for duct risers. The problem, therefore, resolved itself into the comparative merits of a high velocity versus a medium velocity system.

Air at Medium Velocity

Eventually a medium velocity of approximately 3,000 fpm was selected over a high velocity system for the following reasons:

1. A 3 in. static pressure at the fan sufficed for medium velocity rather than the 6 to 7 in. static pressure required with a high velocity system.
2. There was far less likelihood of noise in the duct risers.
3. The fans required for medium velocity are Class 1



Six main supply fans each with a capacity of 60,000 cfm.

and, therefore, less expensive than high-pressure blowers.

4. Power required for operating medium pressure fans is only one-half the power for high pressure fans.
5. Expensive sound absorbers are not necessary.
6. Conventional rectangular ductwork is used at a lower cost than special high pressure circular ducts.
7. Space occupied for rectangular vertical risers is only about one-third greater than that occupied by the high pressure circular ducts.

Two areas were found for return air shafts. One was the existing unused space between the elevators; the other was an abandoned dumbwaiter. These two shafts were used to bring return air from all the floors to the fan room on the roof. In order to provide flexibility of operation during the cooling, heating and ventilating cycles, it was decided to install return air fans at the top of each shaft. During the heating or cooling cycles, these fans would return this air to the air conditioning equipment, where it would be mixed with outside air, then heated or cooled and put back into circulation. During the ventilating cycle, the return air would be exhausted to the atmosphere and 100% outside air would then be circulated through the store. This use of the ventilating cycle greatly reduces refrigeration costs during much of the year. Once more the roof top location proved its value in facilitating the relief of return air to the outside so as to provide required flexibility of operation with this installation.

Controls

An individual thermostat was installed in each zone to actuate the face and bypass damper serving that area. There are 38 such zones in the store and this multiplicity of zones has resulted in a system which is extremely flexible and efficient. It was found that the most economical system for controlling these dampers was an electronic system as the small control wires could be easily fished from the thermostat locations back to the fan room. Furthermore, this system provided the greatest sensitivity and accuracy of room temperature control.

Controls were also provided to maintain desired proportions of fresh air and return air and proper temperature of air leaving the heating and cooling coils. For these purposes, a pneumatic control system was found to be the most desirable.

This combination of electric and pneumatic controls did not lead to any complications as the equipment controlled by each system was entirely independent of the other. An interesting feature of the control system is a master control panel installed in a convenient location in the fan room. This panel allows the operator to control the temperature at each zone in the store and the amount of fresh air admitted to the system. In addition, it gives a visual indication of the temperature in each zone.

Electrical Distribution System

The design of the electrical distribution system is unique and was the result of much study and analysis. Just as running low velocity air ducts through the sales floors would have occupied too much valuable space, it was found that the use of low-voltage bus duct or multiple conduits would have presented a similar problem.

The utility company would provide power at only 120/208 volts. It was found that at no increase in cost for the wiring, the owners could install their own transformers in the basement to step the voltage up from 208 volts to 2400 volts. At this voltage the wiring could be brought to the roof in relatively small conduits. The 900 hp compressors are operated at 2400 volts, which is more economical for that horsepower. For the pumps, fans and other auxiliaries, a voltage of 440 volts was selected as this provided the most economical selection in motors, starters and wiring. Unit sub-stations were installed in the machine room to step the voltage down from 2400 volts to 440 volts. Because of the power company's stringent starting current limitations on the large motors, wound rotor motors were selected for the 900 hp compressors. As practically full capacity reduction was available with constant speed motors, the motor resistors were selected for starting duty only on the 900 hp motors. All other motors are of the squirrel cage induction type.

Motor Control Center

The centralized location of all equipment made the use of a motor control center an ideal selection and the starters for all equipment were grouped in the switchboard. As a result of this feature and the master control panel mentioned, the operator has the entire air conditioning plant at his fingertips.

From results obtained during the first two months of summer operation, it can be said that the centralized system has provided excellent conditions throughout the store with practically no noise and at a great saving in maintenance and operation. The quality of the system obtained and the complete lack of interference with store operations have resulted in an installation which has been most pleasing to the owners.

Credits

The entire installation was supervised by Gilbert Carson, chief engineer of Shillito's. Refrigeration was supplied by York Corp.; cooling tower by Lilie Hoffmann Cooling Towers, Inc.; controls by Minneapolis-Honeywell Regulator Company. The air distribution system, consisting of all ductwork, fans, coils, etc., was installed by B. & J. Jacobs Co., Inc. of Cincinnati.

A Quick Reference Guide to

Successful Refrigerant Piping

for Air Conditioning Systems

FRED K. LADEWIG
Manager, Kansas City Office, The Trane Company

The primary function of the piping which connects the four major components of the refrigeration cycle—compressor, evaporator, expansion valve and condenser—is to provide for the circulation of refrigerant. A refrigerant exists in a gaseous state in some parts of the refrigeration piping system and in a liquid state in others. These are called vapor lines and liquid lines, respectively.

THE refrigerant is in a gaseous state in the hot gas and suction lines. The piping connecting the compressor and condenser is called the hot gas line. The suction line connects the evaporator and the compressor. The line connecting the condenser and the expansion valve is known as the liquid line.

In addition to carrying refrigerant, a second, and equally important function of refrigeration piping is to provide a continuous return of oil from the system to the compressor. Refrigerant comes into contact with the lubricating oil on the cylinder walls of the compressor. Some of this oil is carried by the refrigerant into the discharge line and on through the system. If the piping is not designed for proper return of oil, loss of capacity or serious damage to the compressor can result.

Note: This article is based entirely on the use of refrigerants in the chlorinated hydrocarbon series, namely: CCl_2F_2 (Freon-12, Genetron-12 and Isotron-12) and $CHClF_2$ (Freon-22, Genetron-141 and Isotron-22). "Freon" is a registered trade-mark of E. I. du Pont de Nemours & Company, Kinetic Chemicals Div.; "Genetron" is a trade-mark of Allied Chemical & Dye Corporation, General Chemicals Div.; and "Isotron" is a trade-mark of the Pennsylvania Salt Mfg. Co.

In its liquid form, a refrigerant will mix readily with oil; but in its gaseous state, the refrigerant and oil will not mix. Therefore, pipes carrying refrigerant gas must be sized for velocities high enough to entrain the oil and carry it through the system.

Basic Rules

When designing a refrigerant piping system, six basic rules should be applied. They are:

(1) Use oil traps wherever they are necessary to effect uninterrupted return of oil to the compressor. Construct the trap so that the horizontal dimension is as short as possible to prevent accumulation of excessive quantities of oil. This can be accomplished by using one street ell and one standard elbow as shown in Fig. 1; or, if necessary, by using two standard elbows cut down and connected by a short stub of pipe.

(2) Size all lines for a total pressure drop within the maximum recommended pressure drop for good efficiency. Maximum recommended pressure drops for the various lines are:

Suction lines: 1 psi
Hot gas lines: 3 psi
Liquid lines: 3 psi

(3) Size suction and hot gas lines so that the refrigerant gas velocity will be *above* the minimum velocity required for proper entrainment of oil under all conditions. Further, size these lines *below* the maximum velocity required for prevention of objectionable noise

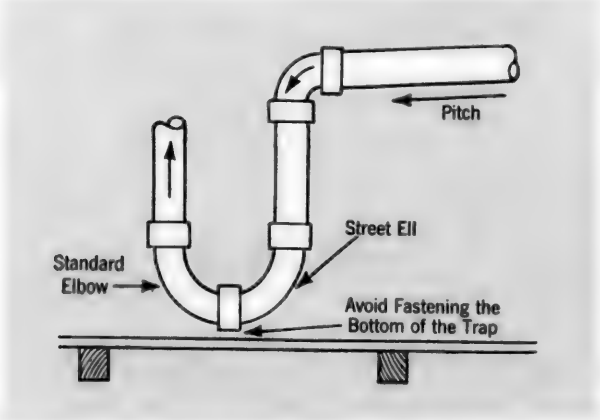


Fig. 1. Detail of oil trap layout in refrigerant piping. The horizontal dimension should be as short as possible.

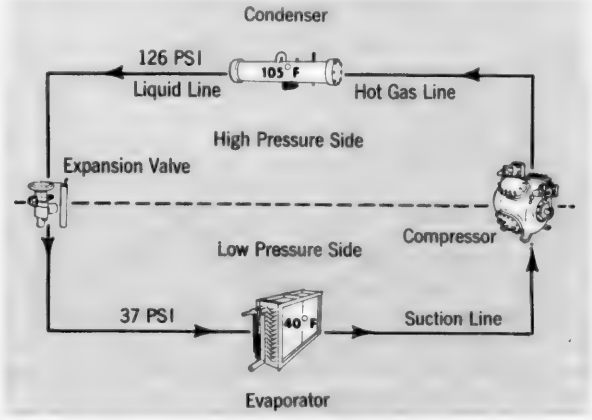


Fig. 2. Refrigeration cycle showing location of suction, hot gas and liquid lines.

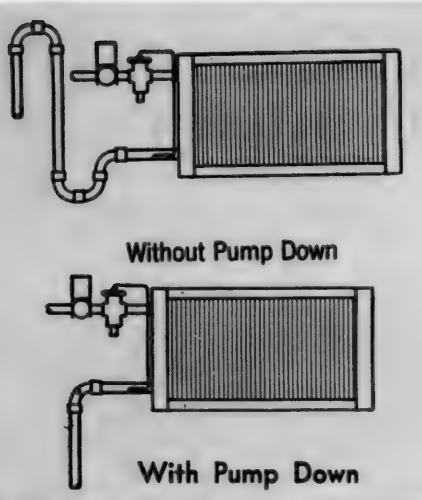


Fig. 3. Suction line hookups when the evaporator is above the compressor, with or without capacity modulation.

or excessive pressure drop. Prescribed velocities are as follows:

MINIMUM VELOCITIES:	
Horizontal Lines	750 fpm
Vertical Risers	1500 fpm
MAXIMUM VELOCITY	3000 fpm

(4) Use double risers in suction and hot gas lines when the compressor has some form of capacity modulation or when multiple compressors are installed. Size the smaller of the two risers for a minimum gas velocity of 1500 fpm at the minimum step of capacity reduction and the larger riser for a minimum gas velocity of 1500 fpm through *both* risers at full load.

(5) Pitch piping down ½ inch in 10 feet in the direction of refrigerant flow.

(6) Keep the layout simple; run lines as straight and direct as possible. Use a minimum number of fittings.

Because the design of the suction and hot gas lines (see Fig. 2) depends upon the type of compressor used, the connections for these lines will be broken down into two categories:

1. Compressor without capacity modulation.
2. Compressor with capacity modulation.

The design of the suction line also depends upon whether or not an automatic pumpdown cycle is used, so that suction line connections must be divided into the following sub-categories:

1. Without pumpdown cycle.
2. With pumpdown cycle.

Pumpdown Cycle

The pumpdown cycle is achieved by the use of a solenoid valve installed in the liquid line close to the thermal expansion valve. The solenoid valve is connected into the control system so that the compressor will continue operating after the thermostat is satisfied and the solenoid valve is de-energized. Thus, the evaporator and suction line are pumped out until only a low pressure refrigerant vapor remains. A low pressure cutout, which senses suction line pressure, stops the compressor when

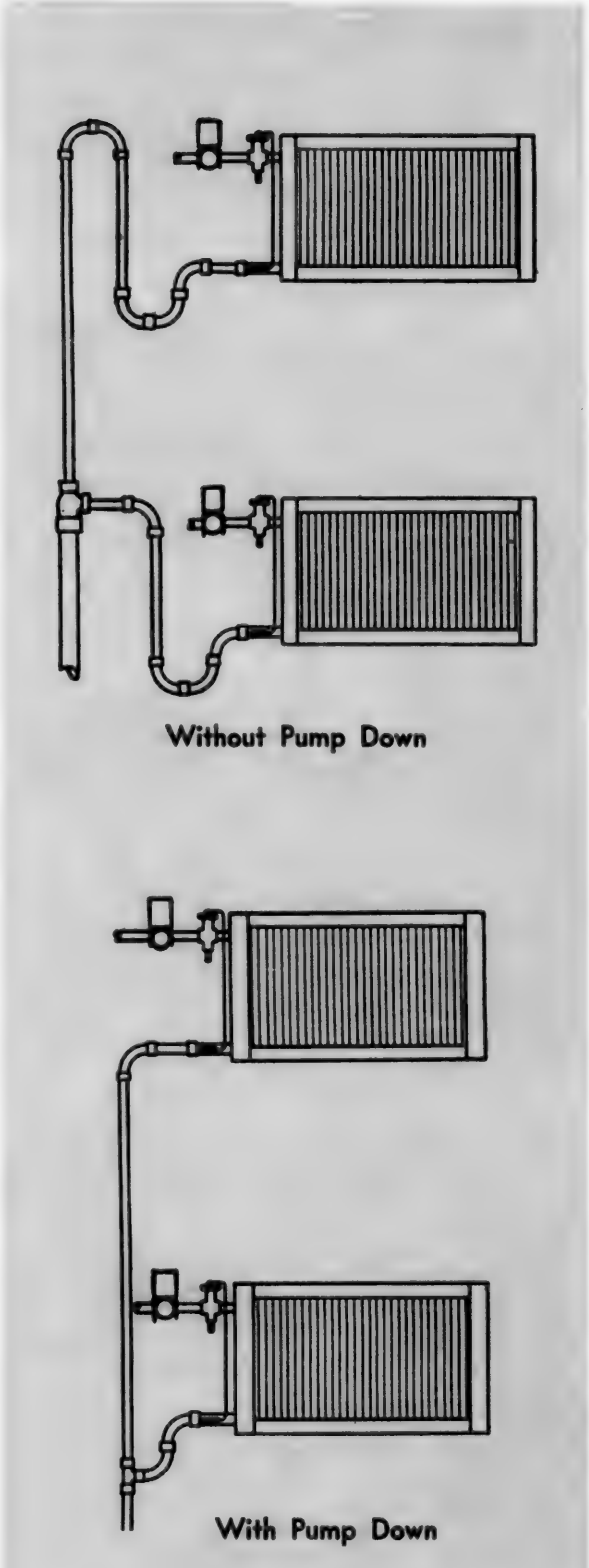


Fig. 4. Suction line hookups when there are two or more evaporators above the compressor, with or without capacity modulation.

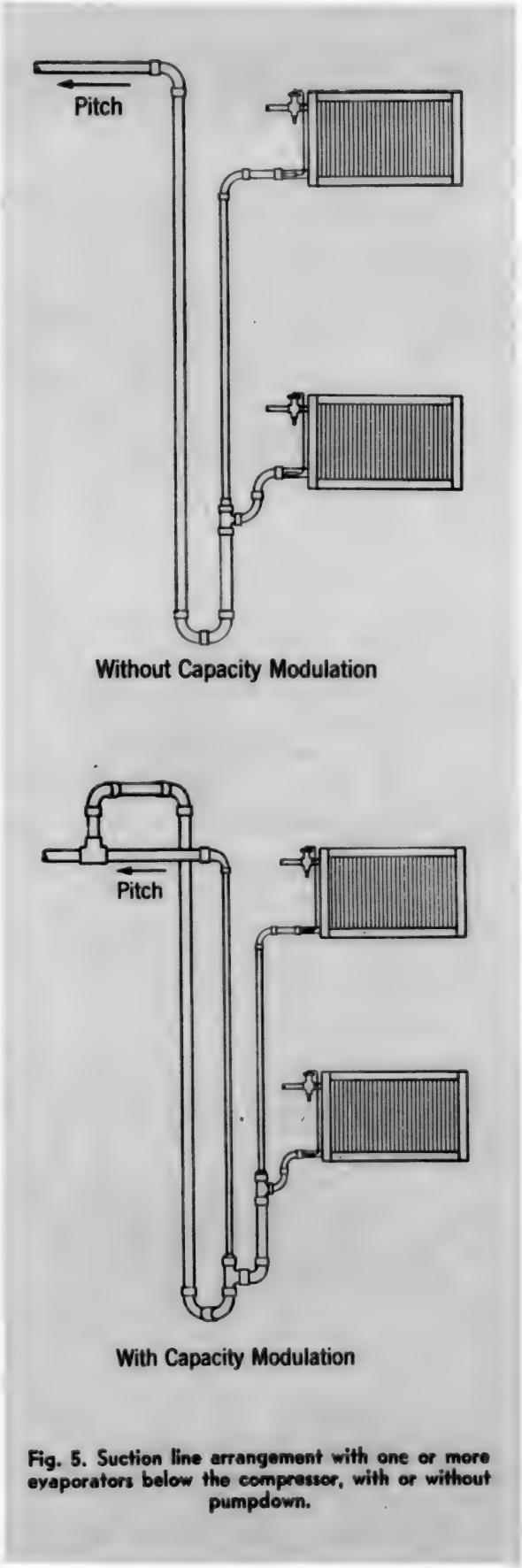


Fig. 5. Suction line arrangement with one or more evaporators below the compressor, with or without pumpdown.

Fred K. Ladewig, is presently district manager of the Kansas City office of The Trane Company, and is also owner of the Ladewig Refrigeration Service Company. Mr. Ladewig is a graduate in mechanical engineering of the University of Wisconsin, 1943. On graduation he entered the U. S. Navy as an ordnance officer and following the war was engaged in steam turbine design with Allis Chalmers Manufacturing Company. He is a member of the American Society of Refrigerating Engineers and the American Society of Heating and Air-conditioning Engineers, and a past president of the Kansas City Chapter of the ASHAE.

this pressure is reduced to a pre-determined setting. The pumpdown cycle is recommended for most systems to prevent return of refrigerant to the compressor in the form of liquid slugs. Liquid "slugging," which can cause damage to the compressor, is the result of not evaporating all the liquid which has passed through the evaporator.

Suction Lines

Various piping arrangements for the suction line are shown in Figs. 3, 4 and 5. The suction line without a pumpdown cycle, as shown in Fig. 3, should loop down, then up to an inverted loop to the top of the evaporator. This type of connection will tend to prevent liquid refrigerant from spilling over to the compressor during the off cycle. The suction line should be free draining when pumpdown is used.

The connections shown in Fig. 4 are similar to those in Fig. 3 with the addition of a double elbow loop out of the lower evaporator when pumpdown is used. The purpose of the loop is to prevent erratic operation of the expansion valve on the lower evaporator because of reactions from the upper evaporator.

If the evaporator is located below the compressor, or if the suction line must rise above the evaporator to provide head clearance, the connections should be made as shown in Fig. 5. With capacity modulation, the double riser becomes a necessity. At part load, the gas velocity in the larger riser will not be sufficient to carry oil up the line. As a result, the oil drops back down the riser to collect in the trap at its base. When sufficient oil has collected to seal the trap, all of the gas flows up the smaller riser at a velocity which will assure return of the oil. When the capacity of the system again increases sufficiently to break the oil seal in the trap, both risers again convey refrigerant and oil. Caution: Trap must be properly made to prevent excess oil collection on reduced capacity.

In Fig. 6 the evaporators located above the suction main are connected in the conventional manner. Evaporators located below the suction main are connected as shown, with the end evaporator tied directly into the main; however, all subsequent evaporators which are below the main should be arranged for inverted, or top entry. If pumpdown is employed, the inverted loop can be omitted on upper evaporators. If the compressor has capacity modulation, double risers must be used on all lower evaporators (see Fig. 5) when the load on the evaporator may vary. In all cases, the short loop at the outlet of each lower evaporator is important.

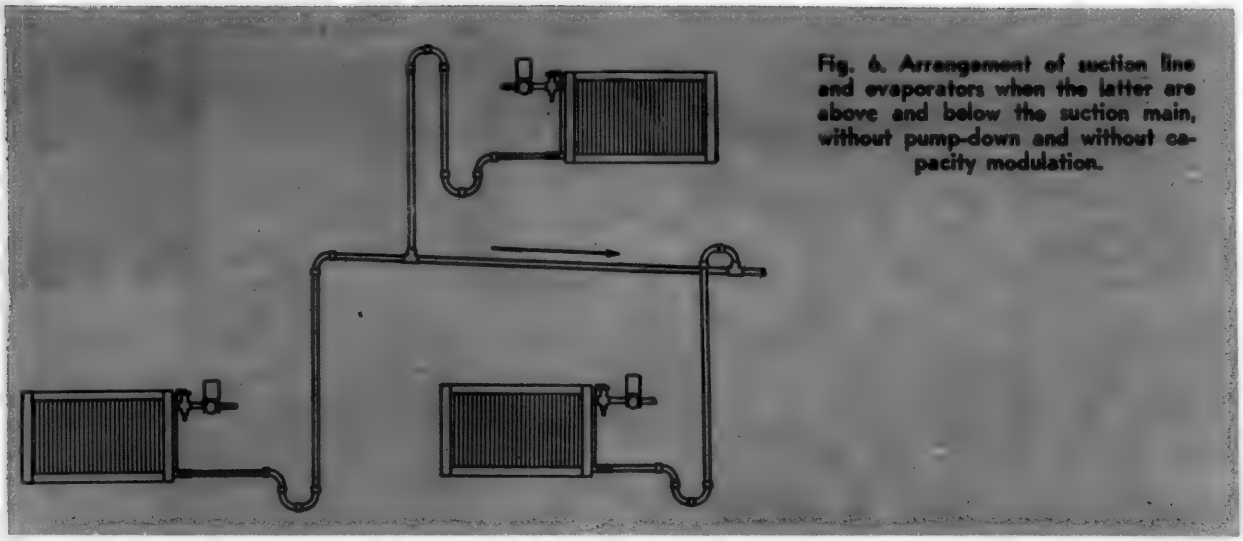


Fig. 6. Arrangement of suction line and evaporators when the latter are above and below the suction main, without pump-down and without capacity modulation.

The suction line should be connected directly to the compressor as shown in Fig. 7. Never install an oil trap (shown dotted) near the compressor as such a trap could cause oil to enter the compressor in slugs.

Hot Gas Lines

Various piping arrangements for the hot gas line are shown in Figs. 8 to 12. The hot gas line to a condenser located below the compressor may be run directly from the compressor discharge service valve to the condenser as illustrated in Fig. 8. The optional, and perhaps more common, method is to rise from the compressor discharge, run horizontally to a point directly above the condenser inlet, and then drop to the condenser. This method is used to provide headroom for access to the equipment and greater flexibility in the piping. The connections to a condenser at the same level as the compressor are similar. In all cases, horizontal lines should be pitched down in the direction of flow.

As indicated in Fig. 9, piping connections for condensers located above a compressor without capacity modulation are fairly simple. If the condenser is more than eight feet above the compressor, an oil trap should be installed at the base of the riser. Long vertical risers are not recommended; but if they must be used, additional oil traps or "lift loops" should be installed at 20 foot intervals.

Condensers located more than eight feet above a compressor with capacity modulation should be piped with a double riser connection as illustrated in Fig. 10.

Mufflers can be used effectively to minimize the noise caused by pulsations in the discharge gas from reciprocating compressors. Unless the muffler is specifically designed for installation in a horizontal line, it should be installed in a vertical line as close to the compressor as possible. Figure 11 shows muffler connections for both single and double risers.

Oil separators find their principal application in (a) systems which employ flooded or semi-flooded evaporators; (b) in systems which use compressors that are designed to "pump oil" (that is, to allow comparatively large quantities of oil to leave the compressor with the refrigerant) (c) in systems which have unusually long runs of pipe; and (d) in certain low temperature systems.

The decision whether or not to use an oil separator in systems other than those where it is an absolute necessity should be based upon this stipulation: *If there is any doubt about the return of oil to the compressor, use an oil separator.* With an oil separator, the basic principles of good piping design still apply. Separators occupy a logical position in many applications, but they should not be considered cure-alls for the oil return problems inherent in refrigeration systems because:

(1) Oil separators are not 100% efficient; some oil will be carried out into the system.

(2) Oil separators contain parts which are subject to failure.

(3) If the ambient temperature at the oil separator is below the condensing temperature of the refrigerant, the gas will condense in the separator during the off cycle. Liquid refrigerant will then pass directly into the crankcase, along with the oil, on start-up. Thus, foaming and possible loss of compressor oil may result.

Typical connections for an oil separator are shown in Fig. 12. The separator should be installed as close to the compressor as possible. Because oil separators act as mufflers in dampening hot gas pulsations, mufflers can be omitted when oil separators are used.

Liquid Lines

The oil return problems which are so critical in the design of suction and hot gas lines are not present in the design of liquid lines because a refrigerant in its liquid form and oil mix readily. The oil does not separate from the refrigerant and will be carried through the system at any appreciable velocity. A problem does exist, however, in that the liquid line must be designed to prevent flashing of the liquid into a gas before the liquid reaches the expansion valve.

The refrigerant is in a liquid form only because of its temperature and pressure. If the temperature is raised sufficiently while the pressure remains the same, or if the pressure is decreased, some of the liquid will immediately flash into gas.

Liquid refrigerant should reach the expansion valve with a minimum of 3 deg of sub-cooling to prevent loss

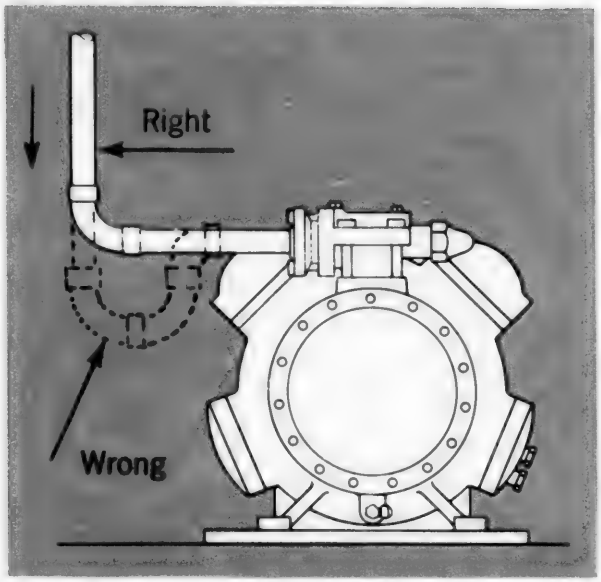


Fig. 7. Suction line connection at the compressor, showing right and wrong hookups.

of valve capacity which results when flash gas is present. Normally, there is little or no heat gain in a liquid line, so that any flashing will be the result of pressure drop from friction or static head. Pressure drop caused by friction can be held to the prescribed minimum of 3 psi by proper pipe sizing, but the effects of pressure drop due to vertical lift can be alleviated only by some method of sub-cooling.

The pressure of the liquid at the bottom of a riser is greater than the pressure at the top simply because of the weight of the liquid. The reduction in pressure amounts to approximately 0.55 psi per foot of riser for CCl_2F_2 and 0.496 psi per foot of riser for $CHClF_2$. If the refrigerant at the bottom of a riser happens to be just at the balance point between liquid and gas, it will flash into a gas instantly if the pressure upon it is decreased. Therefore, before the refrigerant starts up the column, it must be sub-cooled to a temperature below the condensing temperature corresponding to the pressure at the top of the riser.

Sub-Cooling Calculations

To illustrate the effect of static head, refer to Fig. 13 and assume that CCl_2F_2 is the refrigerant, that the vertical rise is 30 feet, and that the pressure in the condenser (Point A) is 126 psi. The pressure-temperature characteristics of this refrigerant are such that at 126 psi it will condense at 105 deg F. The pressure drop due to lift will be 30 x 0.55 or 16.5 psi, which results in a pressure of 126 psi — 16.5 psi = 109.5 psi at the top of the riser (Point B).

At 109.5 psi, the refrigerant will condense at 96 deg. Therefore, the liquid must be sub-cooled below 96 deg *before* it starts up the riser. In actual design work, the pressure drop due to friction must be added to the static pressure drop when calculating the amount of sub-cooling required. Sub-cooling of 10 deg is generally sufficient for elevations up to 25 feet.

Several different methods can be used to sub-cool the liquid. Liquid-to-suction heat exchangers, available as manufactured products, may be used to provide various degrees of sub-cooling. If a single unit is inadequate, two or more heat exchangers may be arranged in parallel. The suction and liquid lines to parallel exchangers should be connected to provide equal flow and equal pressure drop through the exchangers. Suction connections should be at the bottom to allow free draining of oil.

When an evaporative condenser is used, sub-cooling can be obtained by means of a sub-cooling coil built into the condenser. Proper piping consists of connecting the outlet of the condenser coil directly to the receiver in the normal manner, running a line from the bottom of the receiver to the inlet of the sub-cooling coil, and piping the liquid line from the outlet of the sub-cooling coil to the expansion valve. The receiver always should be below the outlet of the condenser coil.

The preferred method of piping a liquid line is shown in Fig. 13. The full vertical rise should be taken at the condenser or receiver, and the expansion valves should be fed from above. Downward flow to the expansion

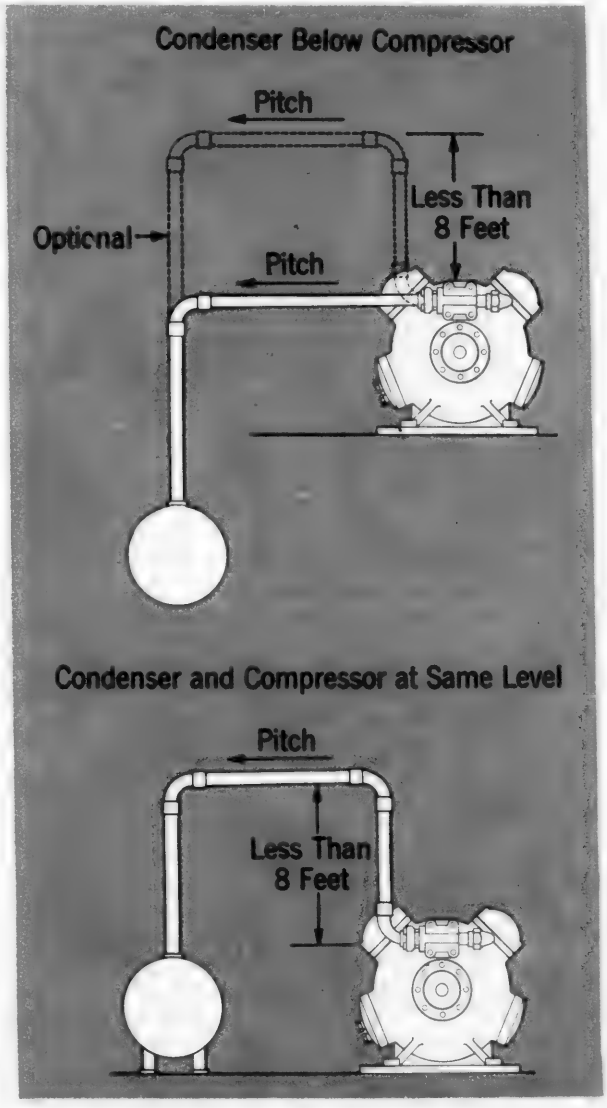


Fig. 8. Arrangement of hot gas line with or without capacity modulation.

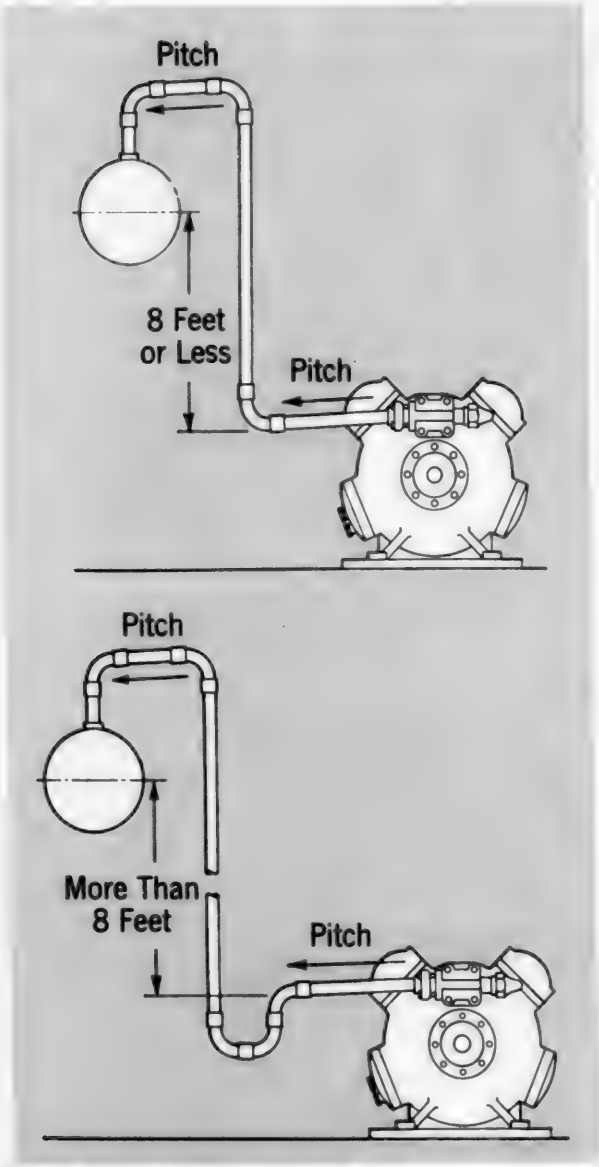


Fig. 9. Hot gas line layout when the condenser is above the compressor, without modulation.

valves will assure even distribution of sub-cooled liquid to each valve. The wrong method is shown by the dotted lines. Upward flow will result in the upper valve receiving most of the flash gas which might be present in the liquid line.

System Balance

While successful operation of a refrigeration system is dependent upon good piping design, it is also dependent upon the proper selection of each of the four major components in the refrigeration cycle — compressor, evaporator, condenser, and expansion valve. Selection of the thermal expansion valve is particularly important. Because the size of the valve is based upon the pressure differential *at the valve*, it is necessary to know the pressure-temperature conditions of the refrigerant at all points in the cycle. The all-too-popular, rule-of-thumb technique of arbitrarily assigning 60 psi as the differential pressure for all expansion valves can lead to costly

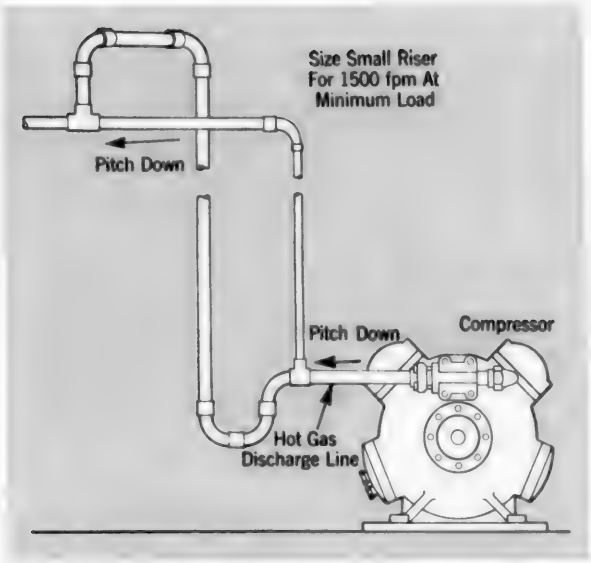


Fig. 10. Hot gas line when the condenser is above the compressor, with modulation.

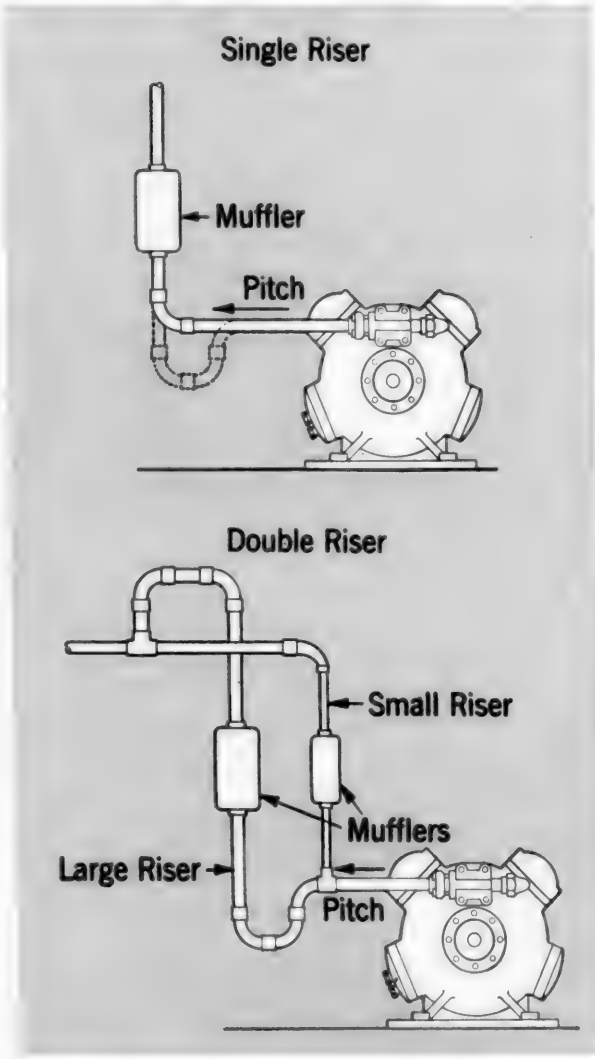


Fig. 11. Muffler connections in hot gas lines.

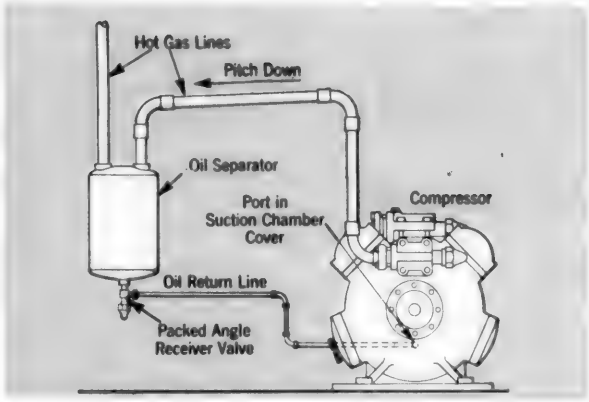


Fig. 12. Oil separator in hot gas lines.

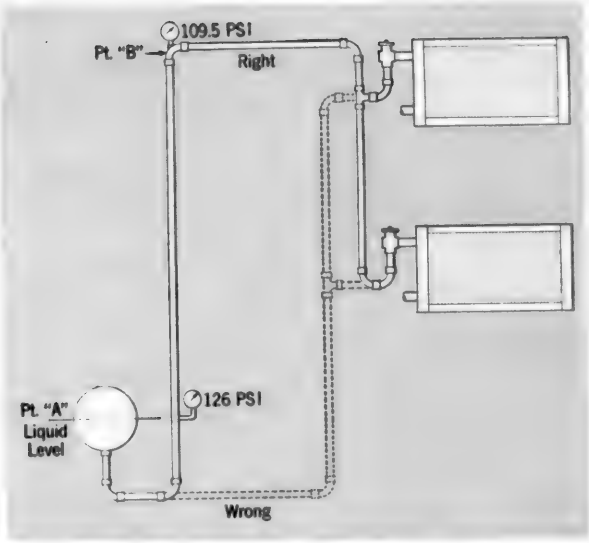


Fig. 13. Right and wrong ways of arranging the liquid line. Dotted line shows wrong method.

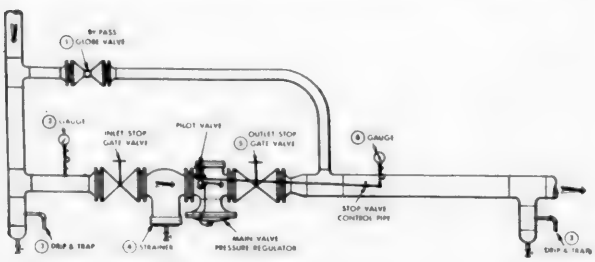
loss in refrigeration capacity. If the 60 psi figure, or any other assumed differential, is too low, the valve will be oversized and will tend to hunt, causing fluctuations in the amount of refrigerant fed to the evaporator. If the pressure differential is figured too high, the valve will be too small, which will result in a starved evaporator and reduced capacity.

System balance can be achieved only by careful analysis of partial load operation, as well as full load operation. Each component must be selected in terms of total capacity required; however, consideration must be given to how it will perform when other components are operating at reduced capacity. Good piping design and proper equipment selection are the key factors in the design of refrigeration systems.

Check List for Steam Pressure Regulator Station

A check list of the accessory equipment needed in laying out a really good steam pressure regulator station has been prepared by engineers of the Spence Engineering Company. In this list, figures are keyed to drawing:

1. *By-pass valve:* This is probably the most obvious accessory and the least likely to be omitted. Without a by-pass a failure of the regulator can force a complete shutdown of the system.
2. *Gage for incoming steam pressure:* If the valve fails to deliver the required pressure, the operator has no way of learning whether the trouble is in the valve or in the piping unless his system is fitted with a gage before the valve. This will permit him to determine the pressure loss through the piping.
3. *Drip and trap:* Here, inlet water (as at the outlet) may collect at low loads. As the load increases, the accumulation is picked up and could cause water-hammer thrown with considerable violence. Note that a dirt leg is placed below the trap take-off. This serves a dual purpose. It prevents dirt from plugging the trap and causing water to back up. Also, if slugs of water are sometimes a problem, a reservoir of this type will take up surges and permit a smaller trap.
4. *Strainer:* Even a normally closed regulator can not close if there is an obstruction between the seat and the disc. The proper strainer will retain almost all foreign matter too large to pass through the regulator. Note that the strainer can be isolated with the regulator for disassembly and cleaning of the screen while the process is fed through the by-pass.
5. *Stop valve on outlet side and valve on control pipe:* Without these valves work can not be performed on the regulator.
6. *Pressure gage in pilot control pipe:* Steam pressure on the delivery side is regulated by the pilot of the main valve. This pilot, in turn, throttles or opens according to the pressure in its control pipe which is attached to the delivery piping. Frequently the delivery pressure gage is installed in the delivery piping itself and in some cases at points quite distant from the main valve. But it is preferable that the delivery pressure gage should indicate the pressure which is actually affecting the pilot. If it is necessary to know the pressure at some point remote from the regulator, a second gage may be installed.



The accessories should not be forgotten after installation. The by-pass and shut-off valves should be operated frequently to be sure they are not frozen when any emergency occurs. Clean out the strainer frequently. Remove accumulated foreign matter. Note that the by-pass valves and piping are so arranged that should, on occasion, access to the strainer screen be necessary, shutting down the entire system is not required.

Packaged Water Chillers for Air Conditioning

GAYLE B. PRIESTER

Air Conditioning Engineer, Baltimore Gas and Electric Company, Baltimore, Md.

Condensed information and specification data are presented for packaged water chillers. Most of these units present a means for air conditioning through the use of fan-coil-filter units installed in offices and other buildings. Many types of packaged water chillers available are illustrated. This is Part 2 of a two-part article. Part 1 appears in the previous issue.

Drayer-Hanson, Inc. (Fig. 7). The hermetic compressor is installed in both the air cooled and water cooled models and is operated by an oversize motor. The steel fin and tube air cooled condenser is sized to assure operation in ambient temperatures up to 120F. Self-contained chillers are specifically designed for small water cooling applications.

TABLE 1 (CONTINUED)—SPECIFICATION DATA FOR PACKAGED WATER CHILLERS

Make	Model No.	Compressor		Refrigerant		Chiller		Pump, Hp	Condenser
		Hp	Type	Type	Flow Control	Type	Outlet, In		Type
Drayer-Hanson, Inc.	WC 5200	2	Hermetic	F-22	Thermal expansion valve	Copper coil	1½	None	Air cooled
	WC 5300	3		F-22			1½		
	AC 5200	2		F-22			1½		
	AC 5300	3		F-22		Copper coil	1½		
Heat Exchangers, Inc.	SWC 10	¼	Hermetic						Air cooled
	SWC 20	½							
	SWC 30	¾							
	SWC 40	1							
	SWC 60	1½							
Heat-X, Inc.	PC-200	2	Hermetic	F-12	Expansion valve	Inner fin copper tubes	1	⅓	Inner fin copper tubes
	PC-300	3		F-12			1	⅓	
	PC-500	5		F-12			1	⅓	
	PC-750	7½		F-12			1¼	½	
	PC-1000	2-5		F-12			1¼	¾	
	PC-1500	2-7½		F-12			1¼	1	
	PC-2000	20	Open belt drive	F-12			3	None	
	PC-2500	25		F-12			4		
	PC-3000	30		F-12			4		
	PC-4000	40		F-12			4		
	PC-5000	50		F-12			4		
	PC-6000	60		F-12			4		
	PC-7500	75		F-12			4		
	CCP 10	⅓	Hermetic	F-12		Inner fin copper tubes, cast aluminum shell	⅜	None	Air cooled or inner fin tubes
	CCP 15	½		F-12			⅜		
	CCP 25	¾		F-12			⅜		
	CCP 40	1		F-12			⅜		
	CCP 80	2		F-12			1	⅓	Shell and tube inner fin
	CCP 120	3		F-12			1	⅓	
	CCP 160	5		F-12			1	⅓	
	CCP 240	7½		F-12			1¼	½	
	CCP 320	10		F-12			1¼	½	
Penn Boiler and Burner Mfg. Co.	PWC 200	2	Semi-hermetic	F-12	Thermostatic expansion valve		¾	None	Air cooled
	PWC 300	3		F-22			1½		
	PWC 500	5		F-12			2		
	PAC 200	2		F-12			¾		
	PAC 300	3		F-22			1½		
Schnacke, Inc.	—	10-60	Direct drive	F-12	Thermal expansion valve	Seamless copper tubes			Shell and finned copper tubes
	CE 50-35		Belt driven	F-12					
	CE 50-40		Open type	F-12					
Servel, Inc.	EY-CS	(2)					2		
Temprite Products Corp.	R-5	1/6	Hermetic			Copper coils	⅜	None	Air cooled
	R-14	⅓					⅜		
	R-17W	⅓					⅜		Water cooled
	R-24W	½					⅜		

(2) Steam absorption unit rated at 25 tons and using 464 lb steam per hour. Refrigerant is water and lithium bromide.

Heat-X, Inc. (Fig. 8). The PC models, available in sizes from 2 to 75 hp, are delivered ready to install. Models 20 hp and larger are shipped with only a holding charge of F-12. The CCP models are cast aluminum coolers. Larger units of this series are supplied with a magnetic starter for the compressor and a manual starter for the pump motor if a circulating pump is ordered. The circulating pump is optional equipment.

Schnacke, Inc. (Fig. 9). Refrigerant piping is of hard drawn copper. System is integrally connected and includes expansion valve, solenoid, strainer, liquid sight glass and charging valve. Compressor is mounted on a compressor plate to frame. Chiller, heat exchanger and condenser are mounted solidly to I-beam and channels. Tubes of chiller are seamless copper; shell is fabricated from seamless steel tubing, and meets ASME requirements.

Servel, Inc. (Fig. 13). Unit employs the absorption type system and it has no moving parts. The entire unit operates under a vacuum at all times; chilled water circuit is under pump pressure and is not a part of the absorption vacuum system. Unit is compact and will

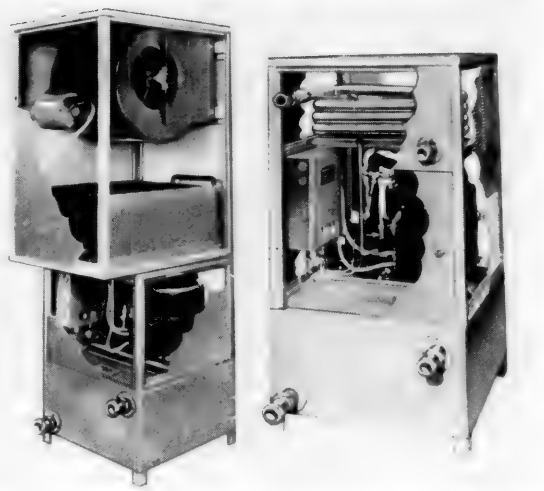


Fig. 7. Drayer-Hanson water chiller. At the left is the air cooled unit, and right, water cooled unit.

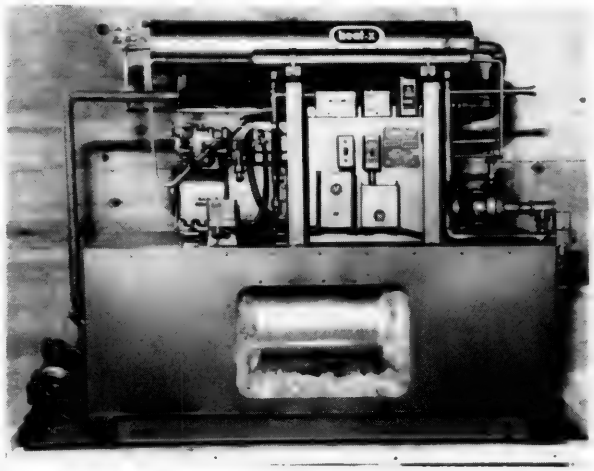


Fig. 8. Heat-X, Inc., mechanical equipment of 2 to 10 hp water chiller.

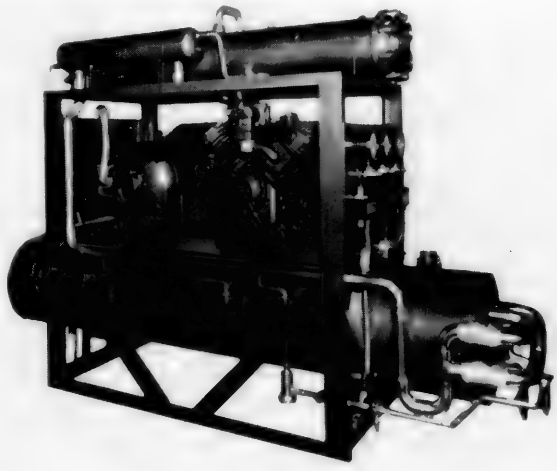


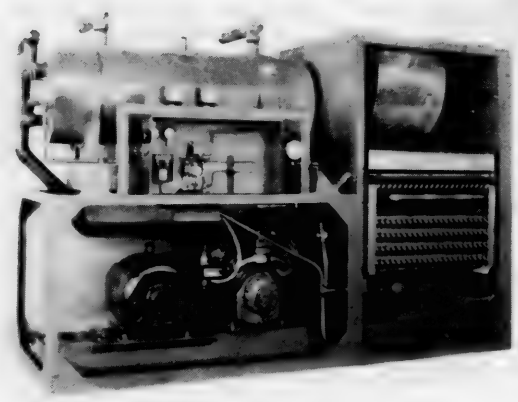
Fig. 9. Schnacke, Inc., belt-driven packaged water chiller of 10 to 60 hp.

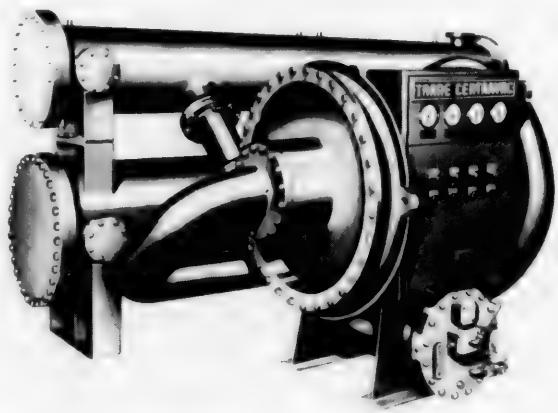
USED AS PART OF YEAR-ROUND AIR CONDITIONING SYSTEM

Outlet, In	Size of Unit, Inches: Length	Width	Height	Weight, Pounds: Shipping	Operator	Control	Factory Charged
1¼	22	22	41				Yes
1½	22	22	41				
	29	22	68				
	29	22	68				
	19¼	13	20				Yes
	23½	14	25½				
	24	23	13				
	34	22	13				
	32	27	23				
½	42	16	28	500		On-off	Yes
¾	45	16	30	650			
¾	46½	18	37	800			
1	57	18	39	1100		2 compressor	
1¼	63½	28	37	1500			
1½	71¾	28	39	2100			
2½	75	35¾	66	2800			
3	75	35¾	66	3200			
3	75	35¾	66	3500			
4	80	37½	76	3900		Cylinder unloading	
4	80	41½	78	4800			
4	85	57	83	6800			
4	85	57	83	7200			
⅜	26¼	18¾	26⅞	190		On-off	
⅜	26¼	18¾	26⅞	220			
⅜	26¼	18¾	26⅞	350			
⅜	24	28	28¼	390			
1½	39½	30¼	30¼	600			
1½	39½	30¼	30¼	800			
1½	51½	30¼	30¼	1000			
2	52	48	48	1400			
2	64	48	48	2200			
½	23	23	33				Yes
½	23	23	30				
½	48	23	33				
	30	37	45				
	30	37	46				
2	90¼	30	82⅞	2950	2500	On-off	Yes
	26¼	12¼	15⅝				Yes
	33¼	14¼	16⅛				
⅜	24	14¼	16⅛				
⅜	24	14¼	16⅛				

TABLE I—SPECIFICATION DATA FOR PACKAGED WATER CHILLERS

Make	Model No.	Compressor		Refrigerant		Chiller		Pump, Hp	Condenser
		Hp	Type	Type	Flow Control	Type	Outlet, In		Type
The Trane Co.	CGB-4	10	Radial direct drive	F-12	Direct expansion	Shell and tube, seamless copper tubes	1½	None	Shell and tube, integral fin copper tubes
	CG2B-4	15		F-22			1½		
	CGB-8	20		F-12			2		
	CG2B-6	25		F-22			2		
	CG2B-8	30		F-22			2½		
	CG2A-4	40		F-22			2½		
	CGA-8	50		F-12			3		
	CG2A-6	60		F-22			3		
	CG2A-8	75		F-22			4		
	CG2A-10	2-50		F-22			4		
	A-11-12	50	Hermetic centrifugal	F-11	Float valve	Integral finned copper tubes	4		Integral finned copper tubes
	B-11-12	75		F-11			4		
	B-13-14	75		F-11			4		
	C-23-24	100		F-11			5		
Typhoon Air Conditioning Co.	WC 30H	2	Belt driven				⅞	None	Copper tubes
	WC 50H	3					⅞		
	WC 75	5					1⅛		
	WC 120	7½					1⅜		
	WC 150	10					1⅜		
	WC 225	15					1⅝		
	WC 300	20					1⅝		
	WC 375	25					2⅛		
Union Asbestos and Rubber Co.	LVA	1					¾		
	LVB	2					1		
	LVC	3					1		
U. S. Air Conditioning Co.	ICA	10-60	Belt driven		Thermal expansion valve				Evaporative shell and tube
	DICA								
	ICW	10-60	Open type						
	DICW								
Worthington Corp.	LCP-8	7.5	Open V or W type with belt drive	F-22	Thermal expansion valve	Shell and copper tubes in U-shaped bundle			Shell and copper tubes
	LCP-10	10							
	LCP-15	15							
	LCP-20	20							
	LCP-25	25							
	LCP-30	30							
	LCP-40	40							
	LCP-50	50							
	LCP-60	60							
	LCP-75	75							
	LCP-80	2-40							
	LCP-100	100							
York Corp.	9DE	25-100	Open type direct drive	F-12 or F-22	High pressure float	Shell and integral finned copper tubes			Shell and integral finned copper tubes





pass through most standard commercial doors. Capacity can be reduced to as low as 50% of rating with corresponding reductions in steam that is consumed by the unit.

Fig. 10, left. United States Air Conditioning Co., chiller with evaporative condenser, 10 to 60 hp.

Fig. 11, right. The Trane Co., centrifugal compressor chiller of 50 hp and larger.

USED AS PART OF YEAR-ROUND AIR CONDITIONING SYSTEM

Outlet, In.	Size of Unit, Inches: Length	Width	Height	Weight, Pounds: Shipping	Operator	Control	Factory Charged
	79	27	63 1/4		2550	Cylinder unloading	Yes
	78 1/4	24 3/4	63 1/4		2600		
	78 3/4	31 1/8	69 3/4		3500		
	125 1/4	26 3/8	66		3600		
	119	27 1/2	74 1/2		4200		
	120 1/8	29 1/4	75 3/4		4700		
	118 1/4	63 7/8	55 3/8		7075		
	126 1/2	60 1/2	58 3/8		6400		
	120 3/4	61 1/2	59 1/2		8000		
	143 1/2	71 7/8	63 3/8		10600		
4	138	100	73	14650		Inlet vane positioning	No
4	138	100	73	14900			
4	138	100	73	15350			
5	178	117	84	19000			
7/8	24	24	33				Yes
7/8	24	24	33				
1 1/8	42	23 3/4	49				
1 3/8	52	27	50				
1 3/8	52	27	50				
1 5/8	62	35 1/4	59				
1 5/8	62	35 1/4	59				
2 1/8	62	35 1/4	65				
3/8	21	21	30				
1/2	21	21	33				
1/2	21	21	36				
1	72 to 144	29 1/4 to 29 1/4	54 5/8 to 58 3/4			On-off cylinder cutout, step control	No
1 1/4							
1 1/2							
1 1/2							
2		34 3/4	54				
2	84 to 174	to 51	to 89 1/2				
2 1/2							
3 1/2							
4							
6							
6	204	46 1/2-50 1/2	81-85				
6	146-194	111 5/8	86 3/4				
	160	61 to 82	67 to 92	4860 to 10330	6300 to 12680	Cylinder cutout	No

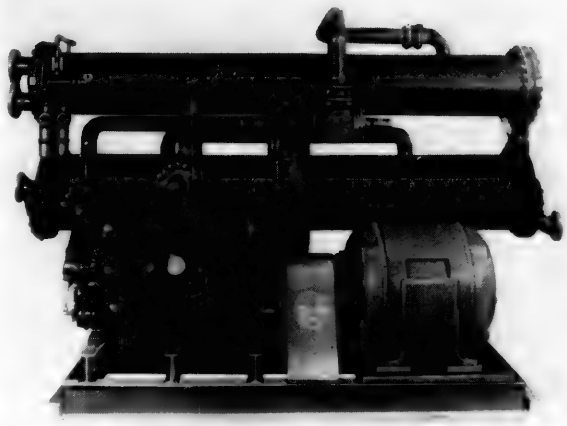


Fig. 12. York Corp., direct driven packaged chiller of 25 hp and larger.

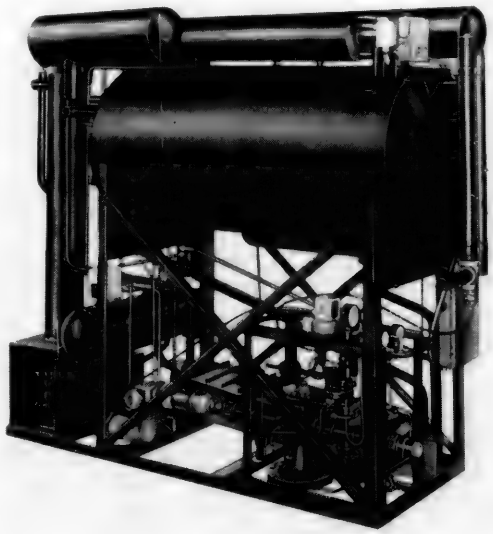


Fig. 13. Servel, Inc., steam actuated absorption water chiller of 25 tons capacity.

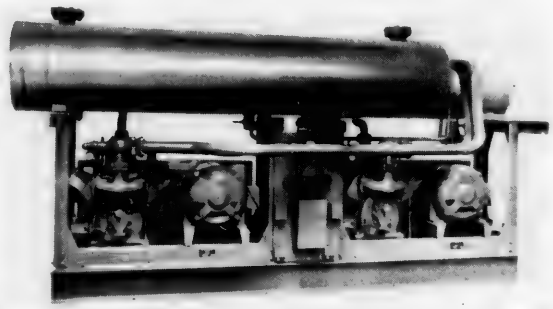


Fig. 14. Worthington Corp., Model LCP-80 liquid chilling unit. Size illustrated is 80 hp.

The Trane Co. (Fig. 11). Units have an oil straining system which incorporates four cleaning processes using fiber wool, a fine mesh screen, magnetic plugs and centrifugal cleaning. Reciprocating compressor is constant speed operating at 1750 rpm. It features unloaded starting and multi-step capacity control. The four largest sizes listed in the table have hermetic centrifugal compressors. Integral motor and impeller construction, together with capacity control and hermetic seal, combine for high efficiency operation. Units from 10 through 40 hp are arranged vertically with the chiller above the condensing unit. The larger models, 50 through 100 hp in the CG series have the chiller mounted beside the condensing unit. The 100 hp model has a duplex compressor arrangement.

U. S. Air Conditioning Corp. (Fig. 10). The two types of water chillers are available with single or dual circuits. A few of the important construction features include: Suction line heat exchangers, rubber-in-shear isolated compressors, anti-cycling control, internal electrical wiring completed at the factory, one-piece construction which includes evaporative condenser or shell and tube condenser with test charge.

Worthington Corp. (Fig. 14). Cylinder unloaders of

(*Concluded on page 166*)

Calculating the Heat Requirements of a Snow Melting System

Part 3—Pacific Northwest Region

WILLIAM P. CHAPMAN

This article, the third in a series planned to cover eventually all those important regions of the U. S. where snow melting systems are likely to be used, is devoted to Washington, Oregon, the northern tip of Idaho, and northwest Montana. Previous installments covered Michigan, Ohio, Western Pennsylvania, Nevada, Utah, southern Idaho, western Colorado and southwest Wyoming.

The first article summarized the basic equation for heat required for snow melting and defined the free area ratio as the ratio of slab area free of snow to total slab area.

In order that each installment of this series can be understood, the opening information on class of systems and the explanation of the four tables are repeated.

THE total heat output of a snow melting system depends on the rate at which it melts the snow, and this rate in turn depends on the relative importance of rapid snow removal among the different types of applications. Snow melting systems can be classified as follows:

Class I (minimum): Residential walks or driveways and interplant areaways;

Class II (moderate): Commercial (stores and offices) sidewalks and driveways and steps of hospitals; and

Class III (maximum): Toll plazas of highways and bridges, and aprons and loading areas of airports.

These classifications depend upon the allowable rate of snow melting. For example, a residential system does not have to melt snow as rapidly as a commercial system. In fact, a depth of snow of an inch for an hour or so during a heavy storm might not be objectionable with a residential system. On the other hand, a store manager would claim the system was inadequate if half an inch accumulated on the sidewalk in front of his store. The difference, then, between a Class I system and a Class II system is in the ability of each system to melt snow. The one feature that is common to all classes is that the systems must be adequate for some combination of weather factors. Or, the designer wants to be able to say that he will pay to melt snow whenever conditions are milder than some critical value, but he is willing to have an inadequate system for a given fraction of the time. In other words, the designer will run a calculated risk providing he knows the odds of that risk. For a residential system,

TABLE 1—GENERAL INFORMATION ON SNOWFALL, PACIFIC NORTHWEST REGION

Item	Seattle-Tacoma, Wash.	Portland, Ore.	Spokane, Wash.
Approximate mean number of days with an inch or more of snow on the ground	20	10	65
Average number of inches of snowfall per year	11.7	12.6	38.2
Greatest snowfall in 24 hours, inches	21.5	16.0	13.0
Greatest depth of snow on the ground, inches	29	19	29
Mean number of days per year with snowfall of 1 inch or more	2	4	13

where initial cost must be at a minimum, the designer must accept more frequent snow accumulations.

Naturally, the owner is not concerned about an explanation of why there is an accumulation of snow on the sidewalk. It is immaterial whether the accumulation is due to an excessive snowfall or whether it is due to an extremely cold snowfall. In both cases, the ultimate reason is that an inadequate flow of heat is reaching the surface. The true analysis of heat output, then, depends on an analysis of the weather. This is true of all three system classes.

The total heat requirements of a snow melting system are determined, therefore, by (a) the total area of the snow melting slab, (b) the rate at which the snow is to be removed, and (c) the values and frequency distribution of each of the pertinent climatic variables (humidity, wind, temperature, and snowfall). Obviously (c) varies from city to city and, due to the complexity and number of calculations to obtain a frequency distribution of the four variables, the evaluation of (c) has been virtually impossible. However, by the use of punched cards and statistical tabulating machines, data have been derived so that the heat requirements for a given city can be simply presented.

The designer needs two types of information. First, the most severe combinations of variables on which to base his *design output*, and, second, the heat required over the season so that *operating costs* can be determined. These data are given in Tables 1, 2, 3, and 4 which follow and which cover three cities in the North Mideast region of the U. S.

Table 1

The first table gives some generalized information on snowfall and snow on the ground. The next to last item, "Greatest depth of snow on the ground" indicates the greatest depth to which snowfall has ever accumulated. Other items are self-explanatory.

Table 2

Table 2 contains the operating information of a snow melting system. For freezing temperatures (32 deg and below) but no snowfall the system may be "idling." That is, the designer may want to supply some heat to the slab so that there will be immediate melting when snow starts to fall. The column on mean temperature gives the average temperature during *freezing* temperatures. This temperature is used in calculating the "idling" load. The other term needed to calculate idling load is the wind velocity during the period of freezing temperatures.

The column "Hours of Snowfall" indicates the number of hours that snow is falling at rates equal to or greater than 0.01 inch of water equivalent per hour. Roughly speaking there are snowfalls of "trace" quantities about twice as often as there are for measurable quantities of 0.01 inch or more. It is assumed that these light falls can be handled by the idling load.

The remaining columns of Table 2 represent the frequency distribution of required heat output. This distribution is based on the solution to the basic equation for two values of the free area ratio A_r. This distribution

TABLE 2—DATA FOR DETERMINING OPERATING CHARACTERISTICS OF SNOW MELTING SYSTEMS, PACIFIC NORTHWEST REGION[1]

City	Period of No Snowfall				Period of Snowfall[3]								
	Air Temperature, Deg F[2]			Wind Velocity, Freezing Period, mph[6]	Hours of Snowfall[2]		Free Area Ratio, A_r	Required Output, Btu per Sq. Ft.[4]						Maximum Output, Btu per Sq. Ft. per Hr.
	Over 32	Below or Equal to 32	Mean Temp. During Freezing Period[6]		Percent	Hr. per Year		0-49	50-99	100-149	150-199	200-249	250-299	
	Per-cent of Winter Hours with No Snow at Above Temp.							Frequency Distribution of Snowfall Hours at Above Outputs, Per-cent[5]						
Seattle-Tacoma, Wash.	88.0	10.8	28.5	5.9	1.2	44	1	86.3	12.3	1.4	—	—	—	137
							0	91.0	8.1	0.9	—	—	—	128
Portland, Oregon	92.9	6.1	28.9	8.4	1.0	36	1	78.0	16.9	5.1	—	—	—	125
							0	91.5	8.5	—	—	—	—	97
Spokane, Wash.	48.5	46.1	25.7	10.7	5.4	196	1	62.6	28.7	7.4	1.1	0.2	—	205
							0	92.0	7.8	0.2	—	—	—	127

[1] The period covered by this table is from Nov. 1 to March 31, incl., with February taken as a 28¼ day month. Total hours in period = 3630.
[2] The percentage in Columns 2 and 3 plus the percent under operating time total 100%. Note that "Hours of Snowfall" does not include idling time, and is not actual operating time. See text.
[3] Snowfalls of trace amounts are not included; hence, "Hours of Snowfall" includes only those hours of 0.01 inches water equivalent per hour snowfall.
[4] Output does not include allowance for back or edge losses since these depend on slab construction.
[5] Percentages total 100% of the number of hours per year of snowfall.
[6] "Freezing Period" is that during No Snowfall when the air temperature is 32 deg or below.

TABLE 3—DESIGN DATA FOR SNOW MELTING SYSTEMS, PACIFIC NORTHWEST REGION

City	Design Output, Btu per (Hour) (Sq Ft)		
	Class I System[1]	Class II System[2]	Class III System[3]
Seattle-Tacoma, Wash. ..	92	128	133
Portland, Ore.	86	97	111
Spokane, Wash.	87	127	189

[1] For Class I (residential) Systems, the design output is set at that required heat output (see Table 2) when $A_F = 0$ at the 98th percentile of the frequency distribution; that is, where 98% of the hours have this output or less.
[2] For Class II (commercial) System, the design output is the maximum output when $A_F = 0$ in Table 2 (last column).
[3] For Class III (industrial) Systems, the design output is determined by the following four requirements: (1) Output is never exceeded for two consecutive hours; (2) Output for $A_F = 1$; Table 2, is at least 1 Btu per hour per sq ft greater than maximum output for $A_F = 0$; (3) A_F is greater than or equal to 0.5 the maximum requirement shown in Table 2 for $A_F = 1$. That is, $q_d = q_s + q_m + 0.5\ (q_e + q_b)$ for the conditions where $q_t = q_s + q_m + q_c + q_e$ are a maximum; (4). The free area ratio A_F is unity for at least 98% of the hours listed in Table 2.

represents the heart of the analysis and is also the basis for Tables 3 and 4.

Table 3

Table 3 contains the *design* heat requirement—as explained in the footnotes to Table 3. These design rates may be altered by the designer if he feels that a particular job should have a different design criterion from those given in the footnote. Any change in design selection should be based on the frequency distribution given in Table 2.

Table 4

Table 4 contains the data required to estimate the operating cost of a snow melting system. The footnotes to Table 4 explain the various items.

Use of the Tables

Example. A Portland, Ore., department store owner has decided that the commercial benefits of a snow melting system justify its expense. He has asked for an estimate of the operating cost for a system covering all of his sidewalk—about 10,000 square feet.

Solution. First, of course, a selection of equipment must be made. What is the required design output? The design rate for a commercial application for Portland as given in Table 3 is 97 Btu per hour per sq ft. From Table 2, the maximum requirement is 125 Btu per hour per sq ft. This is less than 30% greater than the design rate.

With sidewalk systems around stores, one edge is always against a building. In addition, there is often a vault or partially heated space beneath the sidewalk. Both of these conditions would reduce back and edge losses from the system. A strip of edge insulation next to the curb would reduce edge loss still further.

Assume, then, that with intermittent operation that back and edge losses total about 25%. In other words, a Class II system should have adequate capacity for an output of 97 + 25% or, in this case, 125 Btu per hr per sq ft.

Turning to Table 4 note that *Idling Time* for Portland is 221 hr per year and the rate is 17.4 Btu per hr per sq ft. The product of these two terms is 3840 Btu per year per sq ft. The yearly melting load for a Class II system is 1330 Btu per year per sq ft so that the total is 3840 + 1330 = 5170 Btu per year per sq ft. Assuming a 25% loss, the total output would be 6463, say 6500 Btu per year per sq ft. For an area of 10,000 sq ft, the total yearly load would be 65 million Btu.

Assume that the fuel costs, including the pumping costs amount to a dollar per million Btu. The total operating cost then would be $65 per year.

Pacific Northwest Region

The Pacific Northwest region is bounded on the west by the Pacific Ocean and on the north by the U. S.-Canadian border. It includes all of Oregon and Washington, the northern tip of Idaho, and the northwest corner of Montana. The entire region is mountainous, but the cities of Seattle and Portland are essentially at

TABLE 4—YEARLY OPERATING DATA, PACIFIC NORTHWEST REGION

City	Idling			Melting		
	Time,[1] Hr. per Year	Rate,[2] Btu per (Hour) (Sq. Ft.)	Output,[3] Btu per (Year) (Sq. Ft.)	Class	Time,[4] Hr. per Output,[5]	Year Btu per (Year) (Sq. Ft.)
Seattle-Tacoma, Wash.	392	17.2	6,750	I	44	1410
				I	44	1430
				III	44	1430
Portland, Ore.	221	17.4	3,840	I	36	1300
				II	36	1330
				III	36	1360
Spokane, Wash.	1673	39.1	65,500	I	196	8650
				II	196	9350
				III	196	9560

[1] From Table 2, Column 3 × 3630 (hr per year).
[2] Rate when idling, Btu per (Hr) (Sq Ft) = (0.27V + 3.3) (32 — t), where V = wind velocity from Column 5, Table 2, and t = air temperature from Column 4, Table 2.
[3] Product of the two preceding columns.
[4] Hours of Snowfall, from Column 7, Table 2.
[5] Based on the condition that surface temperature is maintained at 33 deg until required output exceeds design output, at which time design output is used regardless of required output. Distribution of required output based on Table 2.

sea level. Spokane, however, is at an elevation of 2400 feet.

The Pacific Coast mountain range on the western edge of Oregon and the Olympic range on the western edge of Washington have a definite effect on this region. In general, the western cities have a milder but wetter climate than the cities in the center or east of the region. Even so, the eastern part of the Pacific Northwest, as represented by Spokane, has a milder winter than the regions to the east of the Rockies. This mildness may be attributed to the fact that the Rocky Mountains form a barrier to the westward movement of air masses from the Great Plains.

There is a distinct difference between the climate of Spokane and that of the coastal areas represented by Portland and Seattle. The eastern and central sections of the region can be represented by Spokane, and the western by Seattle in the north and Portland in the south.

Both Portland and Seattle are inland from the ocean, 60 to 90 miles, respectively, but Seattle is on Puget Sound; hence, Seattle has a climate more nearly like the coastal areas than that of Portland. Both are moist, with Portland considerably more so than Seattle. Portland has about 39 inches of precipitation in the fall, winter, and spring, whereas Seattle has a total annual precipitation of about 34 inches. In each case about one third of the precipitation is snow. For Spokane, however, over half of the winter precipitation is snowfall. As a result, Spokane averages about three times as much snow per year as Portland or Seattle.

The winter temperatures of Portland and Seattle are warmer than for Spokane, and Portland is somewhat warmer than Seattle. Winter temperatures are above freezing 93% of the time in Portland and 88% in Seattle. In Spokane, though, freezing temperatures are recorded 46% of the time, and the average subfreezing temperature is 25.7 deg. as compared to 29 deg. for both Portland and Seattle.

Spokane has nearly 200 hours per year of snowfall but Portland and Seattle only 36 and 44, respectively. Nevertheless, the required heat output is almost identical for all three cities for Class I systems and nearly the same for Class II cities. Due to the colder air temperature, Spokane has a considerably higher requirement for Class III systems. Since Spokane has both a greater requirement and a more frequent use, the disparity in operating costs between the western and eastern sections of the Pacific Northwest region is very great. The operating cost for a snow melting system in Spokane is nearly seven times as large as one in Portland or Seattle.

It seems unlikely that snow melting is practical in Class I or II systems in Portland or Seattle. In Spokane, on the other hand, there is ample need for all classes of systems and the heat requirement is relatively low. As a result, Spokane represents one of the best natural markets for snow melting systems in the United States.

(Next month's installment will deal with the South-East Central region which includes Chicago, St. Louis and Memphis)

Ceramic Is Humidity Sensing Element

Discovery has been reported of a ceramic which may prove to be an especially fine humidity sensing element. The speed of response of the element, important in many industrial applications, has been measured with a resulting response to 90% of the full change of relative humidity in under 30 seconds.

A man-made ceramic, with no natural counterpart, it was one of several being tested in the laboratories of Horizons Incorporated, Cleveland industrial and governmental materials research organization. The work then under contract required the exploring of the dielectrics and the resistance properties of many ceramics when the extremely marked instability of this ceramic was noted.

The strange behavior was noted for rechecking by Edward Mayer, section head of the Physics Department. Several months later upon the completion of the contract underway when the behavior of this Horizons-created ceramic was noted, Mayer addressed a memorandum to Dr. Eugene Wainer, director of research.

"We have noted that the electrical resistance of a certain ceramic exhibits a very marked change in electrical resistance with ambient humidity. Such change in resistance may approximate 2500 fold for a change in relative humidity between 30% and 100% and may approximate a two-fold change over the range from 90% to 100% relative humidity, in contrast to conventional sensing devices which lose sensitivity between 90% and 100% and are practically insensitive at 100% humidity."

When the material was examined closely to discern the reason for its instability, it was noted that such instability was recorded where there was uncontrolled humidity, and the rapid fluctuations recorded were due to the increase of the relative humidity from the researcher's hands thereby adversely affecting the resistance and causing the drift. The greater the relative humidity, the lower the resistance of the ceramic core was found to be.

Much work remains to be done with ceramic. Theoretically, for the moment, it is believed that the effect is a surface effect and not a bulk one since the speed of response is so rapid. Calibrations are being made for the material, since an increase of relative humidity from 50% to 60% shows that the resistance will decrease by a factor of one third and a two fold change was noted in the increase of humidity from 90% to 100%.

Additional work is being done in preparing various batches of the ceramic following the precise formula to check variations, if they exist, from batch to batch. This work is proceeding apace since several clients have expressed interest in the material for use in both instrumentation and equipment.

The range of applications is great, since the material in proper form could be used to trigger dehumidifying or air conditioning units. Units could be placed within mothballed ships to indicate changing humidity conditions and motivate equipment to maintain humidity at a constant. Similar industrial applications can be made within pharmaceutical plants where molds are grown or in plants where fine watches are made and the natural humidity of workers' hands tends to affect the parts. The unit is applicable for any situation where humidity and moisture controls are essential to the work or the product manufactured.

The Case of the Air Conditioning Fountain

E. J. UPDRAFT
Partner in Sketchwell & Updraft, Engineers

M'Uncle Abner kills two birds with one stone in a case involving an atmosphere room in a big department store

M'UNCLE Abner Updraft, who solves problems that stump other engineers, not only resembles Abraham Lincoln in being long and lanky and with a craggy face, but like Honest Abe he is quick to see the relationship between what are apparently totally unrelated situations. For instance, when he saw the living Devil in the ash pit of Dusenstein's Department Store, red face, horns and all, M'Uncle Abner knew right off how he could air condition the India Room, and he knew then the answers to some other pretty important questions, too.

This adventure with the Devil started just like any other problem-solving case, when Karl Dusenstein, Jr. came into the office looking like a well-inflated basket-ball after a hard game. He mentioned he was superintendent of his father's store.

"I know," said M'Uncle Abner unravelling his long legs comfortably. "Biggest store in town."

"We've grown with the city," Karl, Jr. admitted modestly. Then he grew agitated. "But today, Mr. Updraft, we face a crisis because our store engineer wants to build a cold water fountain right in the middle of the India Room, and my father intends to let him do it."

"This is a crisis?" asked M'Uncle Abner, his eyebrows arching upward. "Don't they have fountains in India?"

"Of course they have," snapped Karl, Jr., impatiently. "But this idiot engineer says it will air condition the India Room, and my father has agreed to pay him $10,000 for the design, with installation extra, and it won't work. After all, you know, I graduated in engineering from State College, and I can tell a fraud and a steal when I see one."

M'Uncle Abner took a long breath and regarded Karl, Jr. in the patient way A. Lincoln must have looked at son Tad when the boy came in with a dead bird and wanted it re-activated.

"Back in 1904," he said finally, "Maurice Leblanc of the Westinghouse Company in Paris, suggested a way to cool rooms with water fountains that were chilled by steam jet refrigeration. The scheme was patented in 1910, but, since there was no forced circulation of air, the cooling effect was limited. I doubt you could establish any intent to defraud your father. However—what do you want me to do"

Karl, Jr. hitched his chair a little closer.

"I want you to beat down this fountain idea by designing a proper air conditioning system that I can take to my father. Then I can show him why the fountain won't work."

M'Uncle Abner shook his head.

"Sorry, Karl, Jr. This is a conventional design problem and I don't touch conventional design. I'm dedicated to solving the unsolvable, sir, and nothing else."

"But this *is* an unsolvable problem," countered the round face, the eyes blinking as though tears were right behind them. "My father insists that no ducts shall be seen, and he won't accept visible grilles, registers or diffusers, and worst of all he says air movement is out because air movement would disturb the languorous, perfumed stillness that is the spirit of the India Room."

Karl, Jr. then hauled his basket-ball roundness out of the chair and jabbed at M'Uncle Abner's chest with a fat forefinger.

"Conventional? Hah! Is it conventional to deliver chilled, filtered, ventilating air without visible ducts, without visible grilles, registers or diffusers, and finally, without any air movement? Is it? I ask you!"

"Easy," said M'Uncle Abner soothingly. "Obviously it's impossible, that's a fact. Miss Fanny," he called to his secretary, "Please, ma'am, will you bring us some coffee from the coffee machine? And have a cup for yourself—I'll include it in my fee."

As they sipped the hot coffee, M'Uncle Abner learned that the India Room was of all masonry construction, solid concrete outside walls, floor and ceiling, and that the inside walls were of clay tile, too thin to conceal a pipe, let alone a duct. For additional information, Karl Jr., told him that the India Room abutted the boiler and machinery room, that the engineer's name was Joe Uniflow, and finally that M'Uncle Abner should keep clear of Dusenstein, Senior, until the new air conditioning scheme was developed and agreed upon.

"Dad probably wouldn't talk to you anyway," said the basket-ball like figure, calm now that M'Uncle Abner was going to help him. "Confidentially, we're having a terrible time with theft. Jewelry, silver, fine silks, imported linens, and we don't know how the stuff is getting out of the store. We've got the place full of detectives, we even put the police dogs to patrolling the hardest hit departments at night, and all they did was treat furniture like trees. It's been going on for six months, and Dad is

Abner had never expected to see the Devil rise up in person out of the ash pit in Dusenstein's Department Store.

worried sick. He spends most of his time screaming at the police."

"Can't help you there," said M'Uncle Abner. "I'm a machinery hound, not a man hound."

He pulled out an aged and bulky gold watch, contemplated its time-worn hands and said:

"Meet me in your India Room in two hours, and I will undertake to give you a solution to your problem, sir. That will be satisfactory, I hope?"

"The impossible in two hours?" gulped Karl, Jr., looking as though he had a preview of tomorrow.

"Not the impossible," said M'Uncle Abner smiling the way Abe Lincoln must have smiled at times at his son. "Just the possible which is equal to the impossible."

After Karl, Jr., had rolled off on his worried way, M'Uncle Abner packed his black leather bag with his sling psychrometer, velometer, thermometers, sounding hammer, stethoscope, paper and pencils, and prepared to make a first hand study of the India Room.

"May I go along, Mr. Abner?" asked Miss Fanny, blinking her pretty eyes excitedly. "So you can give me notes, and facts, and such, right on the spot?"

M'Uncle Abner smiled down at her from his craggy height.

"I reckon you'll do more work, and cost me less, if you stay right here. Besides, I want you to call Dusenstein's personnel department and find out all you can about Joe Uniflow, where he was before they got him, and so on. I'll 'phone you if I need it."

M'Uncle Abner hurried to the India Room, because he knew the day was a-wasting, and that any minute now, Dusenstein, Senior, might hand over $10,000 for a fountain that wouldn't cool anything but fish. He laid his black bag of instruments on the wrapping desk, but not until he had bowed politely to the girl behind it, and murmured: "With your leave, Ma'am. Just for a few minutes, to rest my arm."

Next he strolled slowly around the room, sneezing a few times because of the Essence of the East perfume that floated everywhere like an invisible fog, and observing how the room was true oblong in shape, with half-round pilaster columns of white stone—Dusenstein called them alabaster—spaced against the walls like somebody's idea of a Hindustani temple. He saw no windows, all of the illumination coming from two magnificent crystal chandeliers hung above the central aisle, and from an indirect lighting trough that followed all four walls, perimeter fashion, just below the ceiling. He also noted that the trough along the wall which separated the India Room from the boiler and machinery room, was dark, and he asked the girl at the wrapping desk if it was always dark.

"It's supposed to be lighted," she said, wrinkling her nose in distaste with the situation, "but every day or two it burns out, then I've got to stop whatever I'm doing and call the engineer to put in new bulbs. I'd think he could fix it to run a week or two, at least. Here he comes now."

A slender individual dressed in dungarees, even to the cap, came clumping through the India Room carrying an extension ladder under one arm, and a big canvas sack of light bulbs under the other. He set the ladder against the wall under the dark trough, lugged up his sack of bulbs, and commenced making replacements.

"Is that Mr. Uniflow?" asked M'Uncle Abner.

"That's him."

"Does he have an assistant?"

"Two of 'em," said the girl. "But they never put in the new bulbs. He always does it himself. Maybe if he let some one else do it, they'd last longer."

M'Uncle Abner sensed this business of the chief engineer's putting in all the light bulbs meant something, but he didn't know what. Maybe he was experimenting with various kinds of bulbs, or trying out changes in the wiring, but as he watched Mr. Uniflow up there fiddling with the light trough, M'Uncle Abner knew this for certain: he could use that light trough as a kind of distribution flume for chilled air. The air would then spill over the edges and drift gently downward to mix with the still and perfumed air below, and nobody would feel it move, or see where it came from, either.

By the time Joe Uniflow came down the ladder, M'Uncle Abner had figured out also a way to deliver the chilled air to the trough, except for a couple of details, and he hardly took time to wonder why the canvas bulb sack looked so flat, now, and what happened to the burned out bulbs. He took out his big gold watch, and the worn hands told him that Karl, Jr. was not due to meet him in the India Room for another half hour. Under the circumstances he wished he had brought Miss Fanny along to make notes, but in her absence he wrote up his proposed design solution in longhand, as follows:

1—Use the light trough for distributing cold air. Raise edges a little if necessary.

2—Change the lighting from bulbs to neon tubes, or fluorescent, to free more space in the trough and to cut down the heat load.

3—Convey chilled air from the machinery room to the trough through the pilaster columns, entering from the boiler room. If columns are hollow, fine. If not hollow, substitute similar fabricated columns which are hollow.

One unsettled detail was the boiler room wall. Maybe a connection to the columns would be blocked by major equipment, so he folded up his notebook and decided to have a look at that wall, because he would feel very foolish if he proposed something that was really impossible.

The boiler and machinery room was pretty crowded with boilers and pumps and water tanks and things, not to mention a pile of ashes that a fireman was hoeing out into the firing aisle from under a stoker-fired boiler. Joe Uniflow was not in sight, so M'Uncle Abner just nodded to the fireman and walked right past him toward the far wall which bordered on the India Room, and he saw nothing there to block his plan except maybe an ash pit and a skip hoist in the corner nearest the street.

The light wasn't too good in that corner, but as he stood there considering the arrangement, M'Uncle Abner clearly saw a man's head rise up from the smoky pit, and the sight made his skin oscillate all over, because there were two horns on the head, one above each ear, and the features beneath the horns were sharp under a coppery-red skin, as though from long exposure to an open fire. Now M'Uncle Abner had never expected to see the Devil rise up in person out of the ash pit in Dusenstein's Department Store, and as he stared into those bright, malevolent eyes, he didn't know whether to offer the visitor a measure of hospitality, as befitted a Southern gentleman, or tell him to go back to Hell, where he belonged. He was still undecided when a hand reached out of the pit and picked up an engineer's dungaree cap lying near the edge, and another hand smoothed down the horns before putting on the cap, and M'Uncle Abner saw that the devil was really Joe Uniflow, red faced from stooping over, and that the horns were side tufts of hair on an otherwise bald head.

Joe Uniflow's bright eyes studied M'Uncle Abner over the edge of the ash pit and he said:

"Ash truck will be here in half an hour and the danged skip is stuck, as usual. Don't think I'll ever get it fixed."

"No, I reckon you won't," said M'Uncle Abner, thinking how the presence of the devil in the ashpit explained so many unrelated matters, including how to use the pilaster columns, and he added, "It's just like those lights always burning out in the India Room, isn't it?"

"What do you mean by that?" and Joe Uniflow's words suddenly became sharp and a little tense.

M'Uncle Abner smiled gravely in his patient, Honest Abe manner.

"We engineers," he explained, "are obliged to weigh effects in the terms of their causes."

Then M'Uncle Abner started his long legs in the direction of Mr. Dusenstein's office, picking up Karl, Jr., along the way, and going so fast that Karl, Jr., had to trot to keep up.

"But we were to agree before seeing Dad," the basketball shape protested, panting more every minute.

"I reckon we do agree," said M'Uncle Abner, "but I haven't time to tell you the details. Just listen while I'm talking and you'll know all about it. Right now, we're racin' an ash truck."

In addition to Mr. Dusenstein, several insurance men were in the office and a parcel of plain clothes men who had *police* evident all over them. All looked up in annoyance as M'Uncle Abner and Karl, Jr., came into the room with Mr. Dusenstein's secretary hanging to Karl, Jr.'s arm and trying unsuccessfully to pull him out again. Nobody spoke, and M'Uncle Abner stood quiet too, to let their attention focus on him.

"Mr. Dusenstein," he finally addressed the man behind the desk who looked like an older edition of Karl, Jr., but with no hair on his shiny head, "I've discovered the way to air condition your India Room and save you $10,000 besides."

Mr. Dusenstein Senior, put his fingers into his ears, squeezed up his plump face until his eyes looked like cracks in a plastic covered pillow, and when he spoke, his words were the bursting out of an overburdened man.

"Dumkopf! You think I should talk air conditioning yet, while I'm being stolen out of business? Go away! Go away, at once! And with such nonsense, interrupt me not again!"

"You will not be stolen out of business," said M'Uncle Abner patiently, "if you will just use that vertical passage in the India Room column for cold air, instead of for stolen goods. Now, your store engineer varies the current on those trough lights and burns them out whenever he desires, and he desires each time a shoplifter has a few valuable items for his canvas bulb bag. When he goes up the ladder, apparently to replace the bulbs, he is well shielded from the floor, and he drops the loot down the hollow pilaster. Later he takes it out through a trap into the ash pit, puts it in protective bags, and out it goes with the ashes, to be recovered later by a friend on the ash truck. Gentlemen, if any of you happen to be policemen, the ash truck is due any minute, and Mr. Uniflow was still in the boiler room when I left it a few minutes ago."

Four coat tails flapped in the wind as four plain clothes men all but knocked over M'Uncle Abner as they dove through the door.

"But the fountain," frowned Karl, Jr., "What was the real reason for that?"

"Did you ever hear of rings and such going down a drain?" asked M'Uncle Abner smiling the way a cat smiles after it has swallowed the canary's last button. "Joe Uniflow knew he couldn't go on replacing bulbs forever, and he planned to collect $10,000 for designing a fountain with a drain pipe that would be a jewelry thief's dream. And now, gentlemen, if you will excuse me, I must get back to some really unsolvable problems."

Then M'Uncle Abner bowed to Mr. Dusenstein, Sr., with the gracious dignity of a successful man who knows he is successful, and walked out in the relaxed manner of Abraham Lincoln after Appomattox.

Reference Section

Frequency Response Methods

W. G. HOLZBOCK

Various ways for providing a stable control system through use of frequency response.

AIR CONDITIONING, HEATING AND VENTILATING—NOVEMBER, 1956

Frequency Response Methods

W. G. HOLZBOCK

This article on Frequency Response Methods follows one on Instrumentation and Control of Boilers in the August, 1956 issue. Step function response was used in the previous article to analyze the behavior of process, in particular the behavior of boilers, heat exchangers and air conditioning systems. Methods for frequency response, which are more time consuming than those for step function response, are described in detail by the author.

FREQUENCY response methods are more cumbersome than step function response methods (see AIR CONDITIONING, HEATING AND VENTILATING, August, 1956 pp. 81-96) because they require special equipment and are more time consuming. From the practical application viewpoint, they are justified for one reason: It is possible to divide a control loop into an arbitrary number

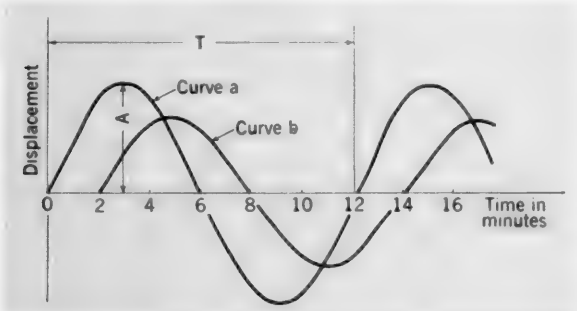


Fig. 1. Sinusoidal curves.

of elements, to obtain frequency response curves of each of the elements and to predict their behavior in the loop or in combination with any other components of which the frequency response is known.

Need for Data

This possibility should be of the greatest importance for the future of control system analysis. If, for example, manufacturers of boilers and accessories would supply frequency response data of all their equipment, it would be possible to determine before the boiler is even installed the control actions and approximate adjustments necessary to keep deviations within predetermined limits under varying load conditions. Work in this direction is beginning. Important contributions already exist, such as those by Y. Takahashi and H. M. Paynter, who have evaluated the frequency response of counter-flow and parallel-flow heat exchangers.

Frequency response is similar to step function response in that it compares the output of a component or a group of components with the input. It is similar also in its object, which is to obtain a stable control system with maximum correction speed. The difference between the two is the form of the input signal, which is a sudden change in one case, and a continuously changing signal in the other.

Sinusoidal Input

The pattern which the continuously changing signal follows is that of a sinusoidal curve, such as shown in Fig. 1. The reason why such a signal is chosen is mainly to allow correlation of mathematical and experimental results, a fact of more academic than practical interest. There is, however, a deeper reason in that many physical systems have responses of a simple sinusoidal pattern. Wherever some elastic restoring force is involved, the springs of a car, the pendulum of a clock or the mercury column in a manometer—the system once its equilibrium is affected by an outside force, will tend to restore its balanced conditions by sinusoidal motions. A periodic motion of sinusoidal pattern, repeating itself at definite intervals of time, is called simple harmonic motion.

The amplitude of a sinusoidal curve is defined as the distance from the mean value to the point of maximum displacement. This is indicated by A, curve a, in Fig. 1.

The time required for the motion to complete one cycle is called the period. Thus, in Fig. 1, curve a, the period T is 12 minutes—after this the pattern repeats itself.

Once the period and the amplitude are known, it is possible to draw a sinusoidal curve by the help of a

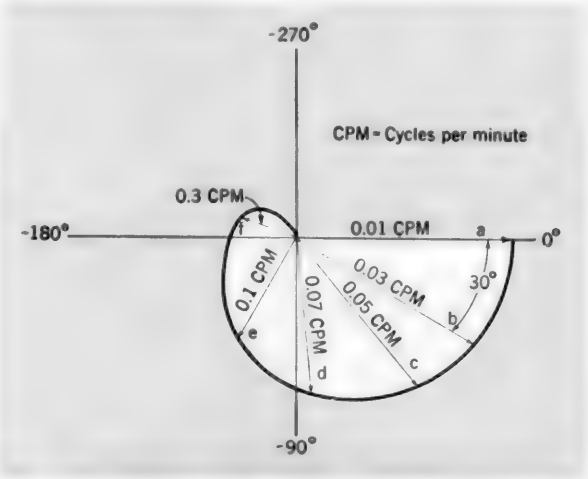


Fig. 2. Polar plot.

trigonometric table, or simply by the following values which are taken from such a table:

Angle, Degrees	Sine
0	0.000
15	0.259
30	0.500
45	0.707
60	0.866
75	0.966
90	1.000

The period T is subdivided into 360 degrees. In Fig. 1 this interval coincides with 12 minutes. Hence each minute is equal to 30 deg. The amplitude is multiplied by the sine value of various points to obtain the displacement at these particular points. Thus the following table is established for curve a of Fig. 1, which has an amplitude equal to A:

Time in Minutes	Angle in Degrees	Displacement
0	0	0.000 A
0.5	15	0.259 A
1.0	30	0.500 A
1.5	45	0.707 A
2.0	60	0.866 A
2.5	75	0.966 A
3	90	1.000 A

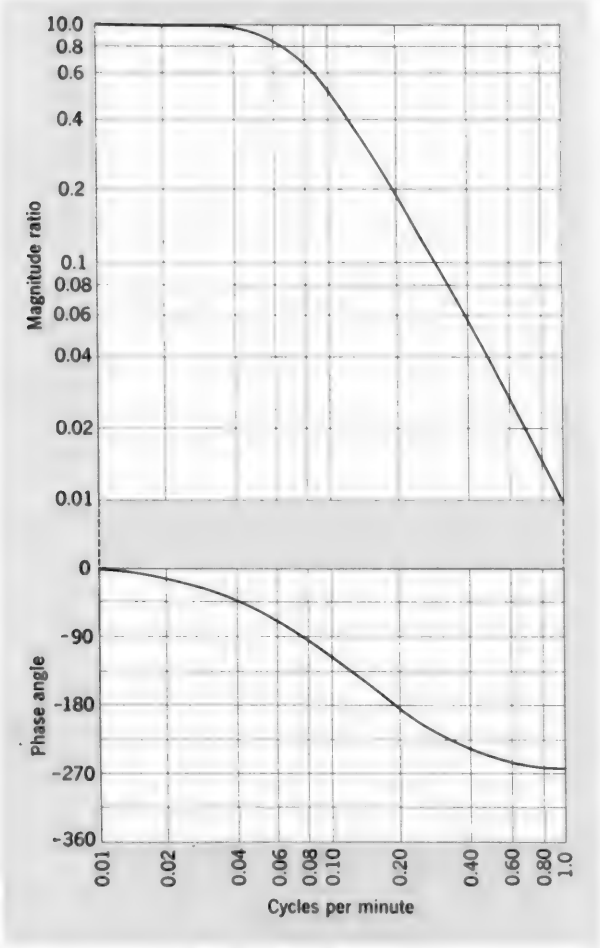


Fig. 3. Bode diagram.

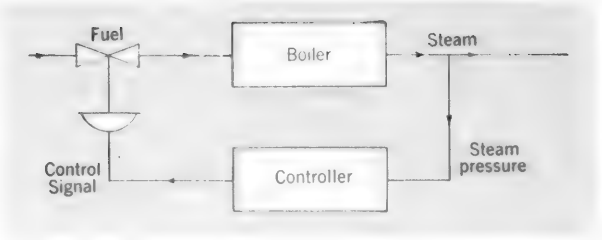


Fig. 4. Closed control loop.

Thus enough points can be established to draw a curve up to 90 deg. From there the preceding table can be used up to 180 deg by taking the values in descending order, that is, 0.966 A, 0.866 A, 0.707 A, etc., for successive intervals of 0.5 minute. It is obvious that by using negative values, the curve can be completed.

Phase Lag, Frequency, and Magnitude Ratio

Figure 1 shows two curves—a and b. These can be visualized as the input and the output of a boiler. Suppose one would cycle the gas fuel control valve according to curve a (this may not be practical but the picture is helpful for the discussion)—then the boiler pressure would follow with a similar pattern, only delayed in action. This delay is equal to 2 minutes in Fig. 1. Such a delay in sinusoidal response is called a phase lag or phase angle, and is expressed in degrees. As previously established, the period T, 12 minutes in the case under consideration, corresponds to 360 degrees, and hence the phase angle is —60 degrees, where the minus sign indicates that the output lags behind the input.

A period of 12 minutes means that a complete cycle of the periodic motion is completed in this time interval. Conversely, this means that 1/12 of the cycle is completed in one minute. The frequency of a sinusoidal input is expressed in those terms, that is, 1/12 cycles per minute is the frequency of either curve in Fig. 1. Thus, the frequency is the inverse of the period.

The higher the frequency of the fuel valve cycling, which means the faster the valve is moved through its periodic motion, the more difficult it becomes for the pressure to follow the input. Although, the frequency of both input and output is always the same, the phase angle will increase and the amplitude of the pressure curve will get smaller. Finally a frequency is reached which is too fast for the pressure to follow and it will stay constant at some average value. The ratio between amplitude of output signal to the amplitude of input signal is called the magnitude ratio.

Graphical Representation of Frequency Response Data

The frequency response of a system coordinates three variables: Frequency, magnitude ratio, and phase lag. Figure 1 informs about magnitude ratio and phase lag at one specific frequency, namely at 1/12 cycles per minute. This does not suffice to draw any conclusions about the behavior of the control system. For that purpose it is necessary to graphically represent the change of magnitude ratio and phase lag at various frequencies. Several methods exist. The polar plot, frequently referred to as the Nyquist plot, has been used for many years.

It has the advantage of combining all the information in a single curve, but it is generally considered more difficult to interpret than the so-called Bode diagram, a method which conveys the same information as the polar plot but in two separate diagrams. The ASME has lately accepted the Bode diagram as the preferred standard for the presentation of frequency response data.

Polar Plots

Figure 2 illustrates the structure of a polar plot. A number of amplitude and phase angle readings have been taken. Six of them are used in constructing the curve. These were:

1. At 0.01 cycle per minute (cpm) the amplitude of the input signal A of ½ inch valve motion resulted in a pressure response with an amplitude B of 40 psi. The magnitude ratio corresponds to B/A and is in this case 80 in. per psi. The length of arrow or vector a is proportional to the magnitude ratio. The phase angle was zero.
2. At 0.03 cycle per minute, the phase angle was −30 degrees, although the magnitude ratio remained the same. The vector b is hence equal in length to vector a but it is displaced by −30 degrees as indicated in Fig. 2.
3. At 0.05 cycle per minute, the phase angle was −50 deg and the magnitude ratio is 72 in. per psi, which is expressed by making vector c correspondingly shorter.
4. Vectors, d, e, and f are of increasing negative phase angle and decreasing magnitude ratio. Actually at 0.7 cycles per minute, the magnitude ratio has decreased to 1.6 in. per psi, which was too small a value to enter on the plot.

By connecting the end points of the vectors, a curve is obtained which can be used for the interpretation of the control system.

The polar plot has been described here because it is an occasionally used method for the representation of frequency response data. No attempt of actual interpretation is made. This is limited to the Bode diagram described in the following.

The Bode Diagram

Figure 3 gives the information of Fig. 2 but in the form of a Bode diagram. The upper curve illustrates the change of magnitude ratio with increasing frequency. The scales used are not linear but so-called logarithmic

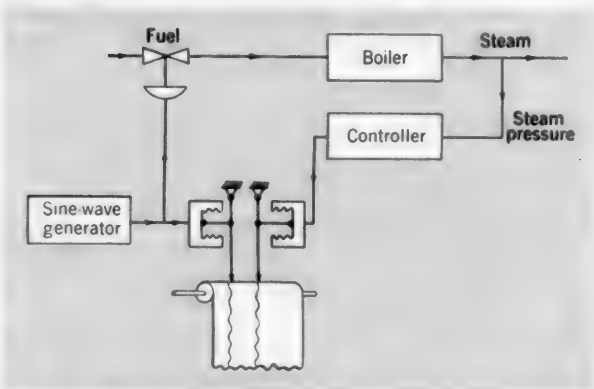


Fig. 5. Open loop frequency response.

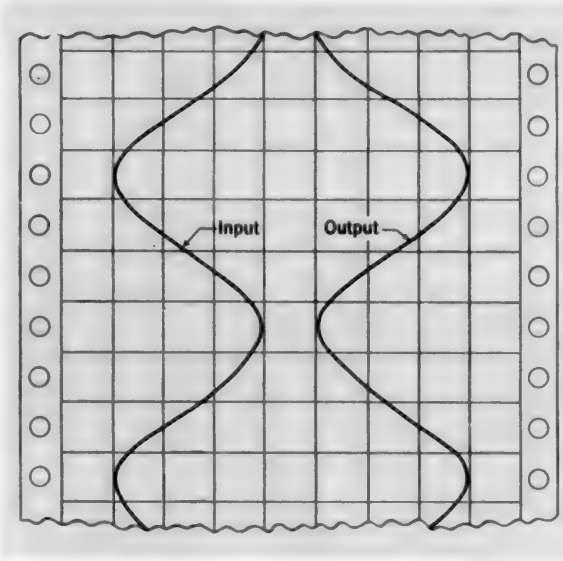


Fig. 6. Response curves.

scales. The distance from 0.01 to 0.1 is the same as the distance from 0.1 to 1.0. Similarly, the steps from 0.2 to 0.4 to 0.6 to 0.8 get progressively shorter. Thus the scale decreases with increasing values. This has the advantage that the lower values are easier to read than the higher ones. It has the further advantage of replacing the multiplication of frequency response data by graphical addition, as will be discussed later.

In the lower diagram, the phase angle is shown on a linear scale while the logarithmic scale continues to be used for the frequencies.

Technique of Taking Frequency Response Data

Figure 4 shows the schematic arrangement of a boiler control system. The controller is assumed to be air operated and with proportional-position action. Fuel is admitted to the boiler, which produces steam. The pressure of the steam is measured and the controller puts out a signal as a function of the deviation of the steam pressure from the set point. The control signal is applied to a control valve which regulates the fuel flow. The interaction of the closed loop is clearly visible.

In order to obtain the frequency response of such a system, it is necessary to open the loop at some arbitrary point. This is illustrated in Fig. 5 where the connection between controller and control valve is interrupted. The closed loop thus becomes an open loop.

An input signal is applied to the control valve. This requires a pneumatic sine-wave generator, a piece of equipment which is not yet commercially available. Many companies, however, have built their own generator. Generally it consists of—

a. A variable-speed electrical motor
b. A cam, linkage, or slider to convert the rotation of the motor shaft into a simple harmonic motion
c. A pneumatic relay operated by b.

The arrangement is basically the same for hydraulic and mechanical sine-wave generators. Where electrical signals can be used, the situation is eased by commercially available generators.

Changing the speed of the electrical motor alters the frequency and suitable adjustments at the linkage or at the pneumatic relay determine the amplitude of the frequency.

Another piece of equipment is the recorder illustrated in Fig. 5, which records graphically both the input and the output of the open loop. It is important that this recorder does not add to the attenuation and phase shift of the input signal, that is, the frequency response of the testing equipment must be considerably above the frequency applied in the test of the open loop. Frequently, oscilloscopes and other electronic equipment are used for this purpose.

A certain amplitude is chosen for the frequency test. For reference purposes, it is quite necessary to always note the amplitude at which response data were taken.

The amplitude is limited by the speed of the components. For example, a valve may move one inch in five seconds. Choosing an amplitude which corresponds to a valve motion of one inch limits the frequency to less than 3 cycles per second. Thus the speed and not the frequency response may become the limiting factor. This shows that high frequency response and high speed do not necessarily go together. A rather slow system, may respond well to relatively high frequencies provided that the amplitude of the signal changes is small.

Once the amplitude is chosen, a number of runs are taken changing only the frequency of the input signal. One usually starts with frequencies low enough so that the output amplitude is equal to the input amplitude. If, for example, both amplitudes are 0.6 psi, then the magnitude ratio is 1. The frequencies are then increased, the data logged and put into graphical form comparable to Fig. 3.

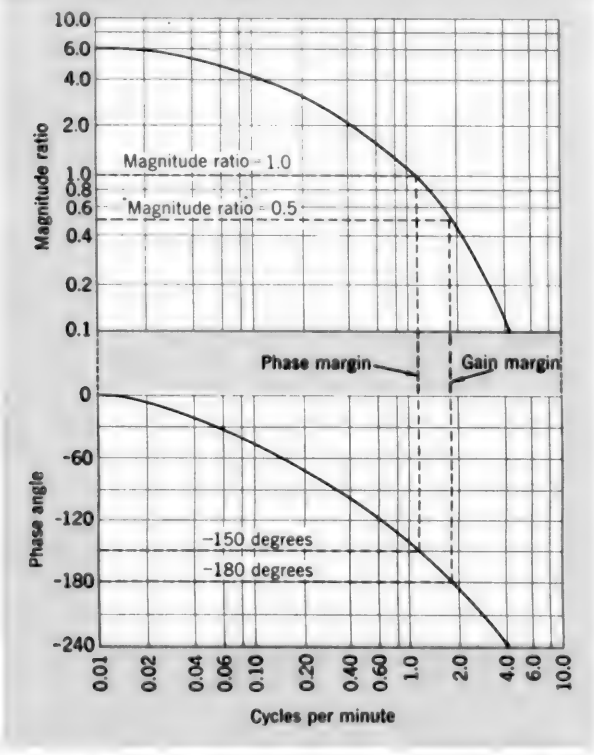


Fig. 7. Frequency response with minimum conditions for stable system.

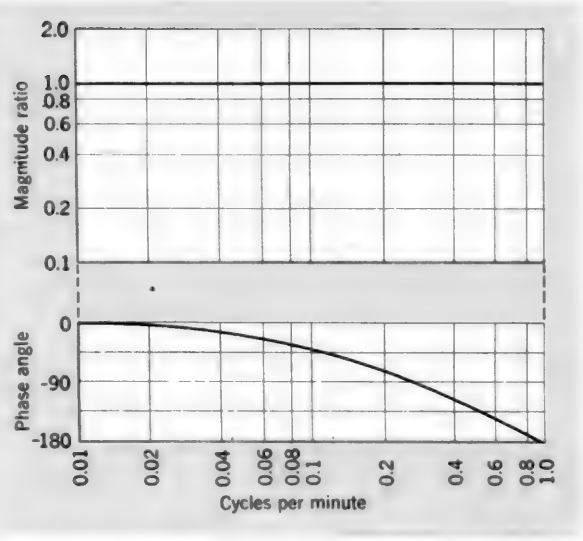


Fig. 8. Frequency response of dead time.

Phase Lag and Phase Reversal

Figure 6 shows response curves such as may be obtained from the recorder in Fig. 5 at a sufficiently low frequency. While the amplitudes of input and output signals are equal, the output is at maximum when the input is at a minimum, and vice versa. Since a full period corresponds to 360 deg, the distance between maximum and minimum of a sinusoidal curve is 180 deg, and the output is said to lag behind the input by 180 deg.

Actually this is not a phase lag but a phase reversal which is inherent in controller action. The controller has to counteract any disturbance in the loop. For example, an *increase* in steam pressure must result in such action of the controller as to *reduce* the steam pressure. This is equivalent to saying that a 180 deg phase reversal as illustrated in Fig. 6 is required. For the representation of the frequency response in the Bode diagram, the phase reversal is ignored and only the additional phase shift is represented as phase lag.

Stability Conditions

Suppose there is an additional phase shift of 180 deg while the magnitude ratio is still unity. In this case the maxima of the output coincide with the maxima of the input. The controller actually repeats the disturbance, sustaining instead of counteracting it. The system is unstable.

The condition of unity magnitude ratio and 180 deg phase lag must therefore be avoided. It is common practice to accept safety margins as follows:

1—The phase lag should not be more than 150 deg when the magnitude ratio is one or more. The 30 deg difference between the acceptable and the unstable condition is called the *phase margin.*

2—At 180 deg phase lag the magnitude ratio should be equal or less than 0.5. For a magnitude ratio of 0.5, it would be necessary to increase it by a factor of two in order to make it unity and hence make the system unstable. The factor by which the magnitude ratio has to be increased to obtain instability is called the *gain margin.*

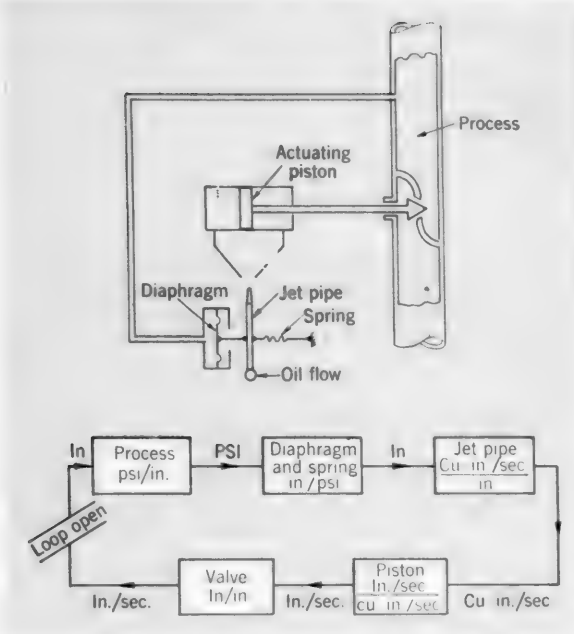


Fig. 9. Block diagram of a control system.

A gain margin of 2 is, therefore, desirable for process control.

Observing these stability criteria results in obtaining the fastest practical control response under stable conditions.

Figure 7 shows frequency response curves which fulfill these conditions. The phase margin is 30 deg and the gain margin is 2.

Dead Time as Instability Factor

It can be concluded from the foregoing that an increase of phase angle without a simultaneous decrease of magnitude ratio will lead to instability, excepting the case where the magnitude ratio is sufficiently below unity at all times. This condition, that is, increase of phase angle at constant magnitude, is the result of dead time, since it represents the time it takes before a change in the loop becomes noticeable. Figure 8 illustrates the frequency response as it results from dead time in the system. This response indicates instability.

Combination of Frequency Response Data

The frequency response of a controller or any particular component is of interest only if the frequency responses of all other components in the control loop are equally known. It is then possible to combine these data and obtain a complete interpretation of the control system's behavior.

Block Diagram

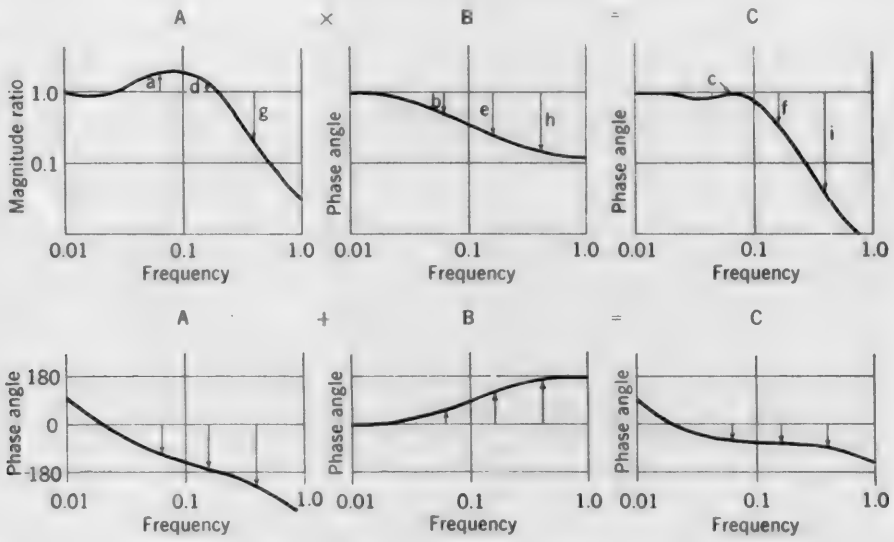
Block diagrams illustrate how the frequency responses of various components in a control loop can be combined. Figure 9 is a typical application of this method for a pressure control system. The pressure is applied to a diaphragm-and-spring combination. When, for example, the pressure increases then the jet pipe is deflected to the right. The deflection is proportional to the process pressure change. Oil is pumped through the jet pipe and leaves it at its tip to be directed into two orifices which connect to the two sides of an actuating piston. As the jet pipe is deflected toward the right, more oil passes into the right-hand than into the left-hand orifice. The piston moves toward the left, opening the control valve, and thereby reducing the pressure in the process line.

In the block diagram, the control system is broken down into its most obvious parts. This is quite arbitrary and different breakdowns are possible. The system is now represented by five blocks, namely,

1. Process
2. Diaphragm-and-spring combination
3. Jet pipe
4. Piston
5. Valve.

The process changes its pressure per inch of valve motion (linear relations are assumed throughout). Hence

Fig. 10. Addition of magnitude ratios and phase angles.



the "process" block reads "psi per in." The valve motion expressed in inches is shown as input and the pressure in psi as output. This pressure is directed toward the diaphragm-and-spring combination, which produces a deflection of inches per psi pressure change. This is converted into cubic inches per second of hydraulic flow by means of the jet pipe and the piston transforms the hydraulic flow into inches per second of piston motion. The valve moves with the piston, and the final outcome is inches per second.

The important fact of all this consists in that a chain of multiplications has been performed by each block around the loop, namely

Process: (inches) × (psi per inch) = psi
Diaphragm-and-Spring: (psi) × (inches per psi) = inches, etc.

Each block acts as a multiplier upon its input. Each input is the output of another block. It is possible to lump together two or more of the blocks into one by a simple multiplication. For example, the "diaphragm-and-spring" block can be combined with the "jet pipe" block by giving the new block the dimensions of

$$\frac{\text{(in.)}}{\text{(psi.)}} \times \frac{\text{(cu. in. per sec.)}}{\text{(in.)}} = \frac{\text{cu. in. per sec.}}{\text{psi}}$$

which is obviously in line with the input of psi and the output of cubic inches per second, since the multiplying of the new block with the input results in the output.

Each of these blocks could be separately submitted to a frequency response test. For example, the process could be analyzed by cycling the valve and measuring the pressure. The relation of output to input both in magnitude ratio and phase lag could thus be obtained. Similar data could be obtained from each block.

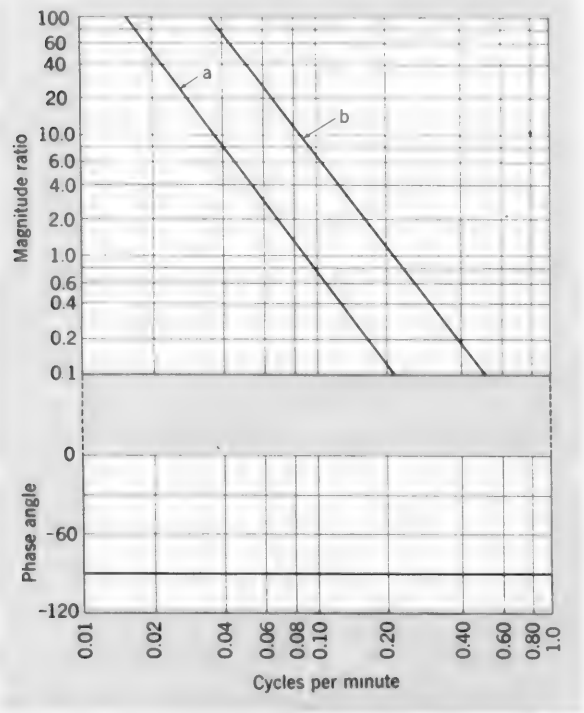


Fig. 11. Frequency response of proportional speed floating action.

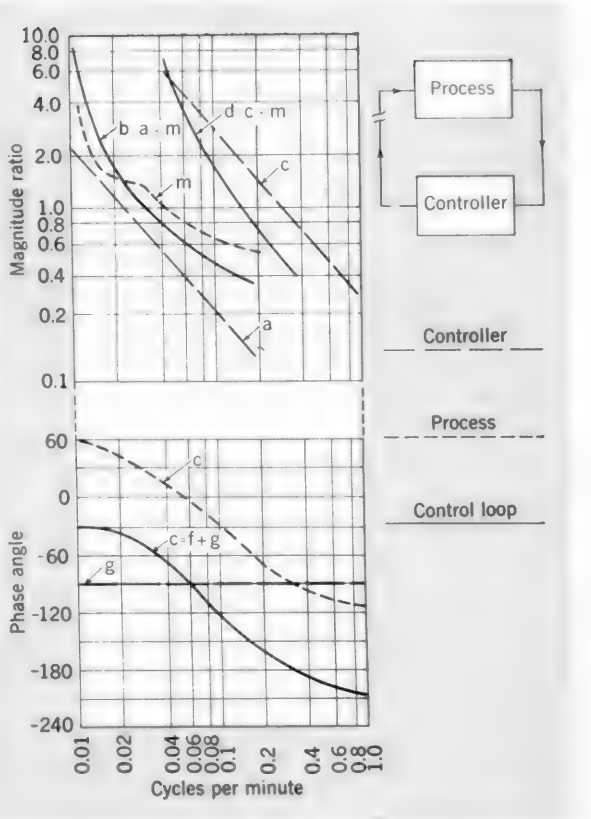


Fig. 12. Proportional speed floating action in control loop.

The magnitude ratio, i. e. the output to input ratios, can be multiplied to obtain the overall magnitude ratio, since they represent exactly the relationship represented in the block diagram.

The phase angles, however, must be added since they represent delays in each block which simply add up as one passes through the loop.

Graphical Addition of Frequency Response Data

The magnitude ratios of frequency response data are represented in logarithmic scales. This puts them in the category of slide rules where the adding of two distances calibrated for the magnitude of the factors is equivalent to multiplication. The result is that the Bode diagram allows one to graphically add magnitude ratios.

Since phase angles are represented on linear scales, their graphical addition corresponds with the physical addition required for phase angles.

The addition of magnitude ratios and phase angles is illustrated in Fig. 10, where the frequency response data of two components, *A* and *B*, are added and the result, or the combined response of the two components, corresponds with *C*.

In order to add magnitude ratio *B* to *A*, the ratio of 1 is used as a reference line. This is obvious when one considers that if the output equals the input, that is, the ratio equals 1, then no matter how many components are connected together, their output to input ratio will still equal 1. It is also obvious because multiplication by 1 does not change the multiplicator. The illustration shows

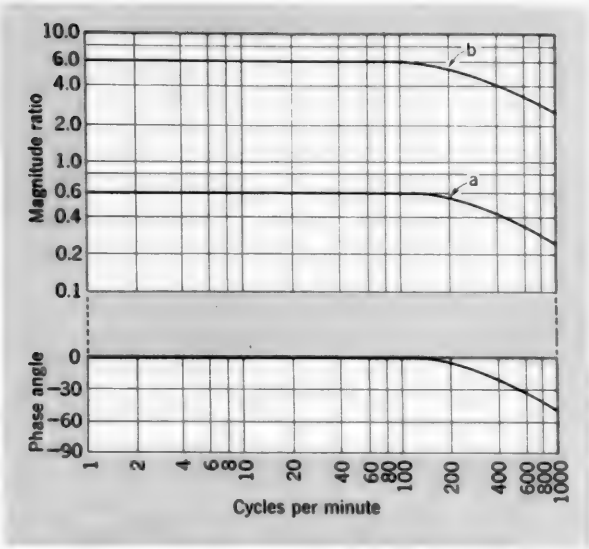


Fig. 13. Frequency response of proportional position action.

three different arrows, *a*, *d*, and *g* which have been added to *b*, *e*, and *h*, respectively. For example, arrows *a* and *b*, which are taken at the same frequency are of equal length, but of opposite polarity. Hence they cancel each other, which is expressed in *C* by point *c* being located at unity magnitude ratio. Adding *d* and *e*, the opposite polarity has again to be taken into account. Therefore, the resultant *f* corresponds to *e* diminished by *d*. The arrow *i* is simply the sum of *g* and *h*, both being of equal polarity. This method of addition results in the magnitude ratio *C*, which corresponds with the combined characteristic of *A* and *B*.

The addition of phase angles shown in Fig. 10 uses 0 deg phase angle as reference. When A lags by 110 deg at a certain frequency and B leads by 60 deg at the same frequency, then the combined phase angle is −50 deg. The illustrated addition is based on this method.

It is interesting to observe that component A in Fig. 10 is unstable, since the phase angle is −180 deg at a frequency at which the magnitude ratio is equal to unity. By adding *B* to *A*, the result is *C*, and the combined response shows stability. This proves that a stable control loop may contain components which, considered by themselves, are unstable.

Proportional-speed Floating Controller

Figure 11 shows the response of a proportional-speed floating controller. As long as an input signal is applied, the output of such a controller continues changing at a certain speed. When the change of the input signal is slower than the floating speed of the controller, then the amplitude of the output becomes larger than that of the input. Hence the slower the frequency of the signal the greater is the magnitude ratio.

The output of a proportional-speed floating controller reverses in direction when the input cycle passes through zero. This is equivalent to a phase lag of 90 deg and accounts for the steady phase angle in Fig. 11.

Two graphs, *a* and *b*, are shown in the illustration for the magnitude ratio. They correspond to different floating rates of the controller.

The magnitude ratio at any given frequency is directly proportional to the floating rate. For example, graph *b* corresponds to a floating rate ten times that of graph *a*. The phase angle remains unaffected.

A process without self-regulation behaves essentially like a proportional-speed floating controller. For example, water in a tank with a constant flow leaving the tank will continue changing in one direction for a given flow into the tank. The phase lag would be likewise 90 deg. If a process without self-regulation is combined with a proportional-speed floating controller, the phase lag of the combination will be 90 + 90 = 180 deg, and at some point of the frequency response curve the magnitude ratio will be 1.0. Hence, this is an unstable combination. The proportional-speed floating controller cannot be used with processes without self-regulation.

Figure 12 illustrates the action of a proportional-speed floating controller in a control loop. In this case, the loop is considered to exist only of controller and process. Graph *a* and *c* are controller responses; graph *m* is the process response; graphs *b* and *d* are the control loop responses of process and controller combined. Initially, the floating rate of the controller is set for condition *a* and the response of the control loop *b* results from combining it with the frequency response of the process.

The phase angle graph *e* is the sum of the phase angles of process and controller. At approximately 0.17 cycles per minute, the phase angle is −150 deg. Comparison with the magnitude ratio curve shows that it is possible to increase the floating rate of the controller considerably and still remain within the conditions of stability.

Graph *c* corresponds to a floating rate about ten times that of *a*. The new control loop response is illustrated by graph *d*. This response has a magnitude ratio of 1.0 at 0.17 cycles per minute, that is, at the frequency at which the phase angle is —150 deg. At —180 deg the magnitude ratio is 0.5. Stability is thus assured but the speed of response of the controller has improved considerably.

Proportional-Position Controller

The frequency response curve of a proportional-position controller would be a straight line, both for the

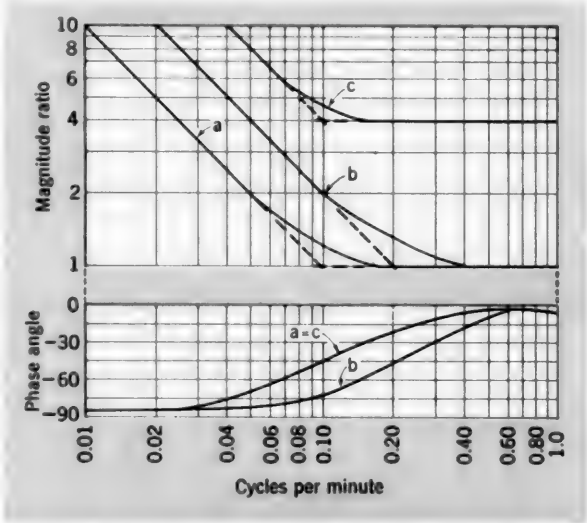


Fig. 14. Frequency response of proportional-plus-reset action.

magnitude ratio and the phase angle up to relatively high frequencies. This is illustrated in Fig. 13. The principle of proportional-position action implies that a change of the input signal is reflected in an immediate output signal of proportional magnitude. Only when the input signal changes very rapidly, then the output signal can no longer follow and attenuation of the signal as well as delay occurs. This produces the decrease of magnitude ratio and the increase of phase lag.

Curve *b* corresponds to a magnitude ratio ten times that of *a*. This is produced by a change in proportional band. Narrowing the proportional band of the controller to one tenth, increases the magnitude ratio by ten. The phase lag is not altered.

Figure 8 may be considered as the response of a control loop containing a proportional-position controller and a process with dead time. It represents an unstable condition. If the dead time cannot be eliminated, it is necessary to increase the proportional band. Suppose the initial magnitude ratio is 1.0 for the process and 1.0 for the controller. Hence the combined ratio is equally 1.0. Doubling the proportional band results in a magnitude ratio of 0.5 for both the controller and the control loop. This assures stability.

The widening of the proportional band results in slower control response. It is the compromise that any control system requires: Greater stability is equivalent to slower corrective action.

The condition which corresponds to a frequency signal that approaches zero cycles is called the steady state.

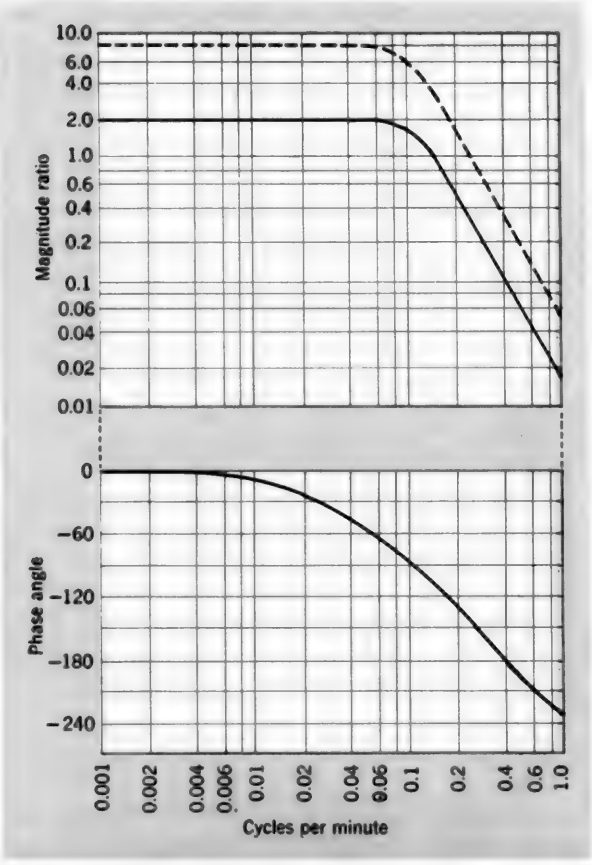


Fig. 15. Frequency response of control loop without reset.

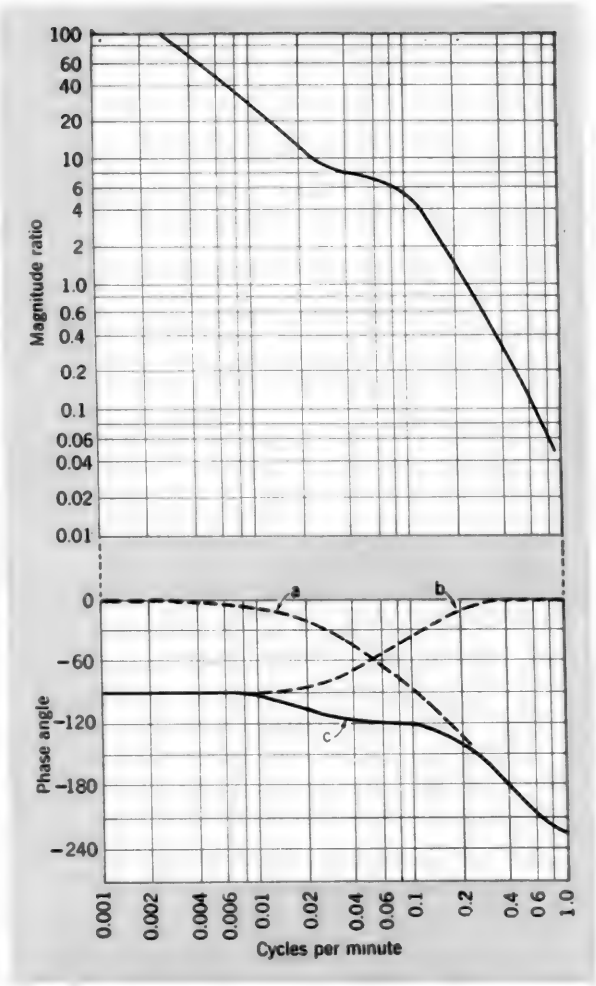


Fig. 16. Frequency response of control loop with reset.

It is equivalent to a control system that after a disturbance reestablishes balanced conditions.

The magnitude ratio of a proportional-position controller at sufficiently low frequencies is 1.0 with 0 phase angle. This implies that for zero input the output will be equally zero.

Offset Characteristic

Offset is an inherent steady-state characteristic of the proportional position controller. It cannot be overcome because the output-input ratio of the proportional-position controller does not increase at steady state and hence no additional impetus can be expected. This is different with the proportional-speed floating controller which shows an increase of magnitude ratio as the system approaches steady-state condition. Comparison between Figures 11 and 13 illustrates the difference between the two control actions: One graph is of negative slope, the other is of zero slope.

Proportional-position action, as compared with proportional-speed floating action, offers the advantage of being an inherently stable component permitting operation at larger magnitude ratios. This increases the speed of response.

A combination of proportional-speed floating and

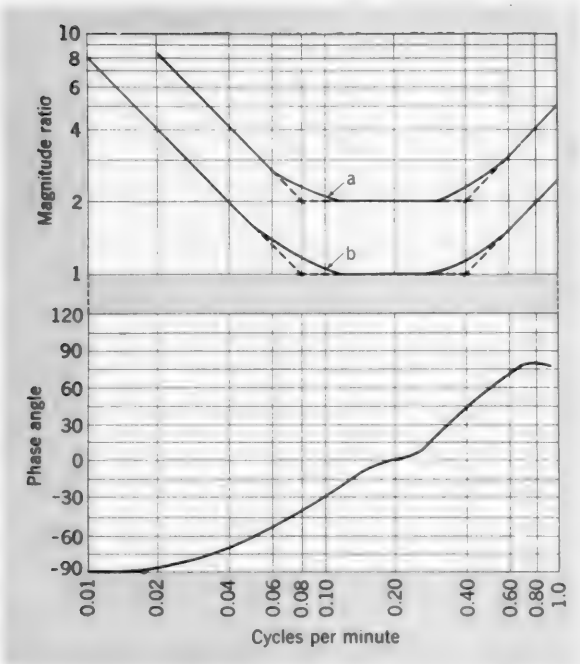


Fig. 17. Frequency response of proportional-plus-reset-plus-rate action.

proportional-position action, that is, a proportional-plus-reset controller, becomes therefore desirable, since it gives fast action and eliminates offset.

Proportional-Plus-Reset Controller

Figure 14 shows the response of a proportional-plus-reset controller. The reset rate of the controller is expressed by the so-called break frequency. This is illustrated by the dashed lines in Fig. 14. Both the slanted line, which corresponds to the reset action, and the horizontal line, which corresponds to the proportional-position action, are prolonged as straight lines. The frequency at which these two lines intersect is the break frequency. The phase lag is 45 deg at the intersection or break frequency.

The reset rate is obtained by multiplying the break frequency by 2π or 6.28. This means that

$$I = 6.28\ f$$

where I is the reset rate in repeats per minute and f is the frequency in cycles per minute. Thus, in Fig. 14, graph *a*, the break frequency is 0.1, and hence the reset rate is $6.28 \times 0.1 = 0.628$ repeats per minute.

When the reset rate is changed, the angle which the slanted line forms with a horizontal line remains unchanged. The slope of this line always expresses a decrease of the magnitude ratio by roughly 9/10 for an increase of frequency by ten times.

The magnitude ratio graph *a* can be shifted in either the horizontal or the vertical plane. Shifting it in the horizontal plane means changing the reset rate. For example, graph *b* results from an increase of reset rate to 1.25 repeats per minute. Similarly, by narrowing the proportional band to ¼, that is, increasing the magnitude ratio four times, a horizontal shift of curve *a* is obtained and curve *c* results.

The phase angle is unaffected by changes of the proportional band, but it shifts when the reset rate is adjusted. This has some effect on the final adjustment of the controller. It is, however, of little practical consequence, as will be illustrated in the following example and can usually be ignored.

Adjustment of Proportional-Plus-Reset Controller

In a previous article (August, 1956) it was described how the reset action of a proportional-plus-reset controller can be adjusted by using the relation:

$$I = 1.2/T$$

where I is the reset rate, and T is the time between two successive maxima of oscillations at the critical setting.

The critical setting which was defined as the widest proportional band at which oscillations occur, corresponds with a magnitude ratio of 1.0 at a phase lag of 180 deg. The time T is the period, the inverse of the frequency, at this condition.

On this basis, it is possible to determine the controller adjustments from the frequency response data of a control loop. These data should be taken with the reset action cut out.

Suppose the results are those of Fig. 15 where the magnitude ratio is 2.0 for frequencies up to about 0.04 cycles per minute, in order to determine the proportional band, the frequency at a phase angle of —180 deg is determined. In this case, it is about 0.27 cycles per minute. The graph of the magnitude ratio is shifted in a vertical plane until a ratio of 1.0 coincides with this frequency. The dashed line corresponds to this condition.

It will be found that the new amplitude ratio is four times the old one at any frequency. This means that the controller sensitivity can be increased by a factor of four, which is equivalent to reducing the proportional band to ¼ its previous value.

To obtain the reset rate, it is necessary to determine

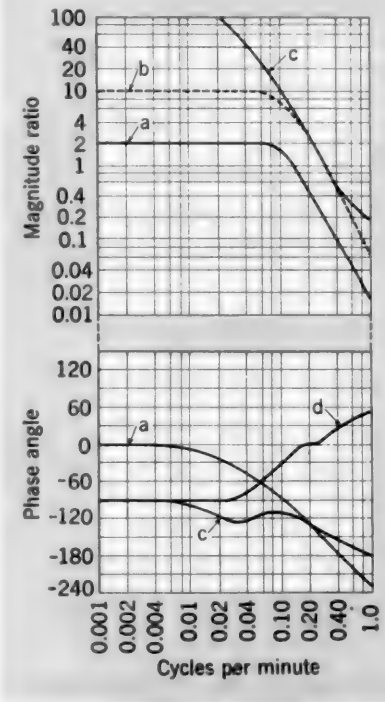


Fig. 18. Frequency response of control loop without and with rate and reset.

the frequency at 180 deg phase lag, which in the present case is 0.42 cycle per minute. This corresponds to a period of 2.4 minutes. The reset rate is then

$$I = 1.2/2.4$$

or 0.5 repeats per minute.

Figure 16 illustrates the change of the control loop response due to the addition of reset action. The condition of the dashed line of Fig. 15 is combined with the added reset. The phase angle is represented in three graphs. One, *a*, is the response without reset action; *b* is the phase angle due to proportional-plus-reset action; and *c* is the resulting combination. Although the *c* curve differs considerably from the original *a* curve, both show the phase lag of 150 deg at practically the same frequency. Hence the stability condition remains unaltered.

Proportional-Plus-Reset-Plus-Rate Controller

The addition of rate action provides a corrective action in proportion to the speed with which a controlled variable deviates from its set point. It is used to compensate for large time constants in the process or in the measuring element, a condition which most frequently exists in temperature control.

Since the effect of rate action is proportional to the speed of deviation, it must also increase its effect with the frequency of a test signal. Figure 17 shows the frequency response of a proportional-plus-reset-plus-rate controller. The increase of the magnitude ratio after about 0.3 cycles per minute is due to rate action. The graph has two break frequencies: One at 0.08 cycles per minute, the other at 0.4 cycles. From the first break frequency the reset rate can be determined as previously described. In this case it is 0.5 repeats per minute. The rate time can be determined by using the equality

$$D = \frac{1}{2\pi f} \text{ or } D = \frac{0.16}{f}$$

where *D* is the rate time in minutes and *f* is the frequency in cycles per minute. Thus in the present case $D = 0.16/0.4 = 0.4$ minutes.

The slope which the slanted line forms with the horizontal is the same regardless of the rate time. Its magnitude is also the same as the slope of the reset action, only it is positive instead of negative. Increasing, for example, the rate time to 0.8 minutes, shifts the right-hand slanted position of the graph to the left until a break frequency of 0.2 cycles per minute is obtained.

By changing the proportional band, the entire graph is shifted in a vertical plane. For example, by cutting the proportional band in half, graph *b* is shifted to become graph *a*.

The phase angle becomes modified by the added rate action and the output signal leads the input signal at frequencies that are under the influence of rate action. In Fig. 17, this starts at about 0.2 cycles per minute.

Adjustment of Proportional-Plus-Reset-Plus-Rate Controller

In the previous article which discussed the adjustments on the basis of step function response, it was pointed out that the proportional band should be twice the critical setting for proportional-position controllers with or without reset. It was mentioned that the proportional band could be narrowed to 1.7 times instead of twice the critical setting when rate action is added. This means that the magnitude ratio can be increased because of rate action. The reason is that the effect of the phase shift becomes noticeable, as will be shown further below.

For the same reasons, when adjusting from the frequency response as in Fig. 18, the magnitude ratio of 1.0 no longer refers to a phase angle of —150 deg but to one of —160 deg. Figure 18 shows in graph *a* the same frequency response as Fig. 15. Reset and rate actions are cut off. Adjusting the response of Fig. 18 for minimum proportional band at stable conditions, results in the dashed line, *b*. The magnitude ratio is now 1.0 at —160 deg and at low frequencies it is 10.0 instead of 2.0, which is 5 times the initial ratio of 0.2 times the initial proportional band. To determine the reset and rate actions, the corresponding expressions of the previous article are used. They were

$$I = 2/T$$

and

$$D = T/8$$

where *I* is the reset rate in repeats per minute, *D* is the rate time in minutes and *T* is the period in minutes referred to the critical setting, that is, to —180 deg phase angle. In the present case, the period at —180 deg is 2.4 minutes. Hence the reset rate is 0.84 repeats per minute and the rate time is 0.3 minutes.

Adjusting reset and rate actions accordingly, and then repeating the frequency response test of the control loop results in graph *c* both for magnitude ratio and phase angle.

The phase angle graph *c* is the result of adding the process phase angles *a* to the controller phase angles *d*. It can be seen that at the frequency at which curve *a* showed —160 deg, the phase angle is now only —150 deg. This justifies the initial assumption of 160 degrees in case of rate action instead of the conventional 150 degrees.

Conclusions

The preceding description was illustrated by graphs which were more or less idealized. Actual readings show frequently considerable random variations for which a smooth curve only indicates a trend. In view of these conditions a differentiation between 150 and 160 deg may become impractical.

Many methods have been presented in the literature that are more elaborate and more accurate, provided that readings can be taken that are as meaningful as they are supposed to be. It is indicative that even in the method used here and which is stripped of all unnecessary complications, the question ultimately arises, if the measurements are not even more approximate than the method. This points to the limitation of frequency response data used for the setting of automatic controllers. For a system which is actually installed, the step function response method is simpler and more reliable than the frequency response. The advantage that remains is that frequency response data allow the combination of several components on paper, without their being installed, and to arrive at conclusions of what approximate magnitude their settings will be.

LOUIS BLENDERMANN ON

PIPING AND PLUMBING

Parking Area Drainage

WHEN a building is located on level or raised ground there is usually no problem in draining the rain water that falls on the site in the vicinity of the building. In fact, the grade immediately surrounding the building is generally sloped away from the building to allow the water to follow its normal path along the terrain and to seep into the earth in a natural way. Thus, for buildings so situated, rainfall drainage is no great concern.

However, a building often will be erected on a site that will include a paved area for parking cars or for other purposes. If the surface of this area is paved with asphalt, concrete or other surfacing materials, only a small per cent of the rain water will be absorbed. Therefore, it is necessary to slope this area to enable the water to run off into the street or to other portions of the property where it will drain into the earth.

Methods for Drainage

When it is not feasible for the water to drain into the earth because of the location of the site and its particular grade slope, then attention must be given to other means to drain the area of its expected rainfall. Other means may consist of connections to storm or sanitary gravity systems within the building, pumping systems, or dry wells.

Every now and then, a condition will be encountered where, because of certain site limitations or other reasons, the parking area is located in a depression. Because of its negative slope, water cannot drain away from the building itself.

Refer to the key plan in Fig. 1. The parking area, which is located behind the building, is in a grade depression with even the driveway pitching toward the parking area. Unless proper steps are taken to ensure adequate drainage, the entire area or at least a portion thereof will remain flooded after a storm. This is not a desirable condition and can only result in considerable annoyance to the owner of the building and his tenants or customers. It will result in criticism of the design.

Dependent upon certain factors, pertinent to the site, there are several methods that may be utilized to rectify this condition.

Sump Pumps

If the parking area is so located with proximity to the building that the space by means of underground piping can be drained into the gravity storm or combined sanitary or storm system within the building, then the disposal of the rain water is greatly simplified. If, however, the parking area is at such an elevation that it

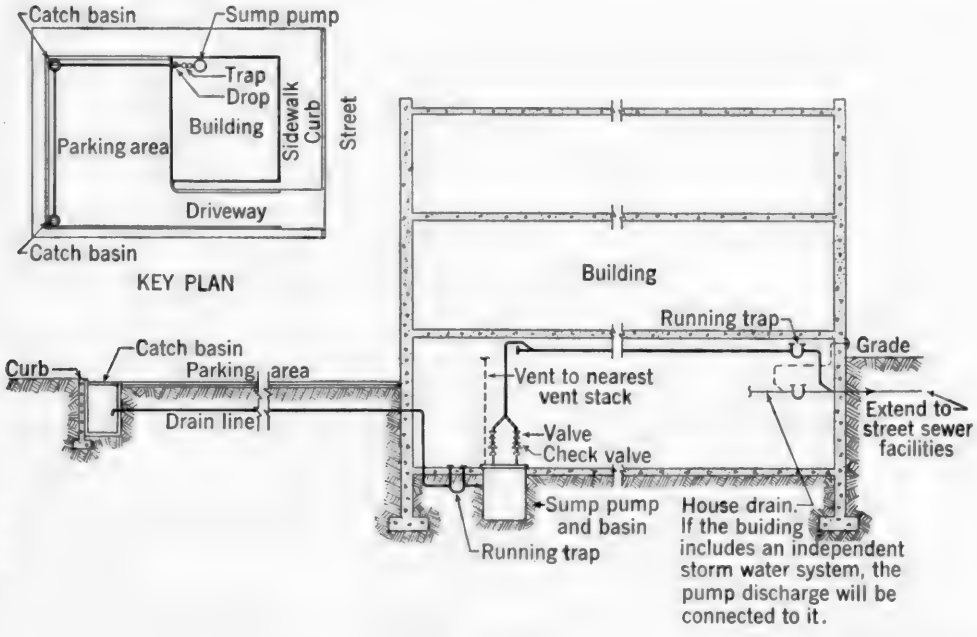
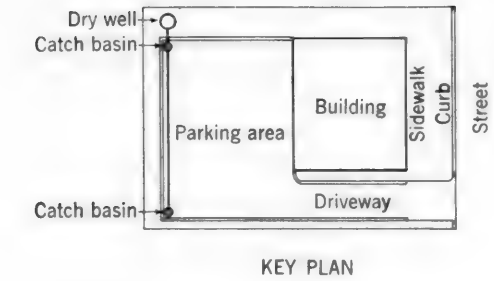


Fig. 1. Method of draining parking area by means of a sump pump installed within the building. Key plan shows the layout of building in respect to the grounds.



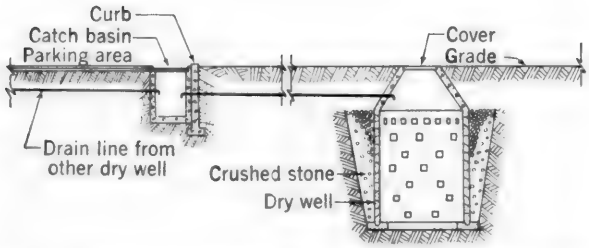


Fig. 2. Method of draining parking area using a dry well.

is not possible to utilize the building gravity systems, then some thought must be given to the application of a sump pump. Figure 1 shows an installation where a sump pump is employed.

As detailed in this figure, the storm water runs into the catch basin from which it is conducted, via the underground piping, into the building and to the sump basin. The sump pump should be of the duplex type and of a capacity to handle the flow during a peak storm. The capacity of the basin is normally determined on the basis of the pumping cycle desired for the pumps. The pumps lift the water to an elevation that will allow the water to drain by gravity into the interior storm water system or combined facilities and thus discharge into the exterior street facilities.

If neither storm or sanitary facilities are available in the street, then the water must be pumped to the curb or other points of disposal.

Dry Wells

If the soil characteristics at the site are porous enough to permit a rapid absorption of the rainfall, dry wells may be employed. Figure 2 is a typical example showing how and where the dry wells are placed.

As shown in Fig. 2, catch basins are set at the low point or points of the parking area. Rainfall runs into the catch basins from which, by means of underground piping, the water is conducted to the dry well. One or more dry wells, as the need may be, are constructed just outside the area of the parking space shown; the dry well should be of sufficient size and capacity to receive the quantity of rain that will fall on the area in a 24-hour period. Rainfall intensity tables will supply data defining the amount of rain that will fall on a specific area in a given time. This data, as well as the leeching rate of the soil, determine the size and capacity of the dry well.

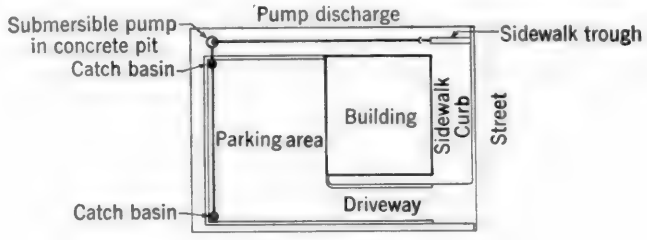
The dry well shown in Fig. 2, is of the pre-cast type because of the extra strength it offers. Crushed stone is placed around the dry well to increase its drainage capacity. Without the crushed stone, the earth would soon become clogged with the silt and debris that settles on the parking area and washes into the dry well with the rain. The crushed stone prevents this by permitting the silt and debris to filter down to the stone thereby greatly increasing the servicability of the dry well.

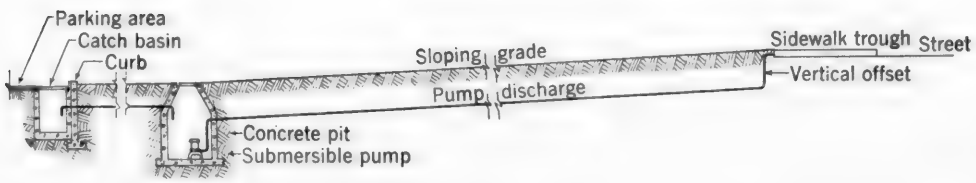
If the earth has a good percolation rate, and the dry wells are placed at an elevation that is high enough above ground water level, the dry well can be counted upon for many years of dependable service.

Submersible Pumps

If the property is so situated that storm or combined sewer facilities do not exist in the street and the ground is not suitable for installing dry wells, then other methods for disposing of the rain water must be explored. The task is further complicated if because of the construction of the building and arrangement of floor space, it is impossible to conduct the rain water to suitable pumping equipment in the building. When these conditions arise,

Fig. 3. Draining the parking area with the aid of a submersible pump. Water is discharged at the curb.





it may be necessary to give some thought to the type of pumping equipment that can be located at the exterior of the building near the parking area. Figure 3, represents a typical installation of this kind.

Referring to Fig. 3, the rain water is intercepted by the catch basins which, in this case, conduct the water to a pit containing the pumping equipment as shown. A submersible pump is used in this example to show the range of different types of pumping equipment available for this purpose.

As the water runs into the pit, the water level rises in the pit until at a predetermined height it actuates the pump. The water is then discharged through the pump discharge and up the grade slope as illustrated, to a point where this discharge runs by gravity out to the curb.

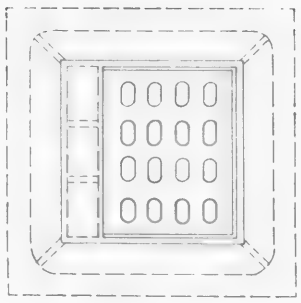
The reason why it discharges to the curb is that this is the only place on the site left for the disposal of the rain water. When water is discharged at the curb it will follow the slope of the street gutter and eventually reach a natural drainage area, as does the rain that falls on the street. Generally, when such conditions exist at the site, it is usual practice to also conduct the roof leaders of the building to the curb and allow the water to discharge at this point.

The pump pit is of the storage capacity that will permit the frequency of pumping cycles desired. The controls for the submersible pump can be located, either over the pit, in the pit, on the nearest exterior wall of the building or at an interior wall of the building. Many types of controls are available for this purpose. In any event, a disconnect switch should be placed in or above the pit for the safety of the maintenance man before entering the pit.

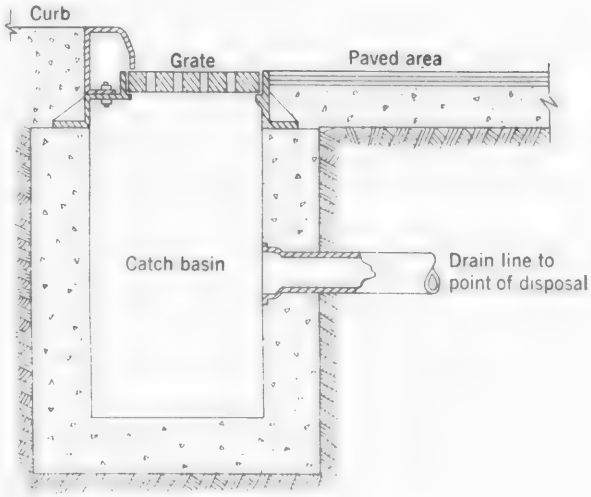
If a regular sump pump is used, the motors would either have to be exposed or contained in a small pump house erected over the pit. However, either method can be used with a good deal of success. The motors for a regular sump pump could of course be located underground but the building of the watertight compartment needed to house the motors might be too expensive in this particular case.

Catch Basin

Figure 4, presents a detail of the catch basin construction shown in each of the illustrations. Although there are many types available for this purpose, this particular one is shown as example. It is a good design. The space provided below the inlet or outlet of the basin is to intercept and retain the debris that washes into it.



PLAN



SECTION

Fig. 4. Typical construction of a catch basin.

Large Paved Areas

When large paved areas are encountered, the same provisions as outlined can be employed with the exception that all of the equipment used, should be of greater capacity. For example, when only dry wells are used, the prescribed number corresponding to the size of the overall area to be drained should be provided. The same consideration must be applied to equipment in the other methods shown.

This same method of treatment can be applied to all types of buildings under similar circumstances where a paved area is to be included. This covers schools, industrial plants, shopping centers, restaurants, public buildings and all other general types of buildings.

Computing Device for Water Content of Gases

A simple hand computer for rapidly calculating the content of gases has been developed by A. W. Diniak and E. R. Weaver of the National Bureau of Standards, Washington, D. C. Of the circular slide-rule type, the new computer is said to be faster, more accurate, and less expensive than previous devices for this purpose. In connection with the Bureau's method for determining moisture in gases, the computer has been used by the armed services to calculate the water content of aviator's oxygen, rocket fuels, and fire-extinguisher gases. The device should also save considerable time in such industrial applications as the determination of refrigerating system characteristics and control of moisture in inert and reducing gases.

The computer is designed primarily to calculate water content and dewpoint of gases.

SATURATION PROPERTIES OF FREON-12

(Continued)

Temperature, Deg. F.	Pressure, Lb. per Sq. In.		Volume, Cu. Ft. per Lb.		Density, Lb. per Cu. Ft.		Enthalpy, Btu per Lb.			Entropy, Btu per Lb. per Deg. Abs.	
	Abs.	Gage	Liq.	Vapor	Liq.	Vapor	Liq.	Latent	Vapor	Liq.	Vapor
15	32.415	17.719	0.011227	1.2050	89.070	0.82986	11.771	67.090	78.861	0.026243	0.16758
16	33.060	18.364	0.011241	1.1828	88.962	0.84544	11.989	66.977	78.966	0.026699	0.16750
17	33.714	19.018	0.011254	1.1611	88.854	0.86125	12.207	66.864	79.071	0.027154	0.16742
18	34.378	19.682	0.011268	1.1399	88.746	0.87729	12.426	66.750	79.176	0.027608	0.16734
19	35.052	20.356	0.011282	1.1191	88.637	0.89356	12.644	66.636	79.280	0.028062	0.16727
20	35.736	21.040	0.011296	1.0988	88.529	0.91006	12.863	66.522	79.385	0.028515	0.16719
21	36.430	21.734	0.011310	1.0790	88.419	0.92679	13.081	66.407	79.488	0.028968	0.16712
22	37.135	22.439	0.011324	1.0596	88.310	0.94377	13.300	66.293	79.593	0.029420	0.16704
23	37.849	23.153	0.011338	1.0406	88.201	0.96098	13.520	66.177	79.697	0.029871	0.16697
24	38.574	23.878	0.011352	1.0220	88.091	0.97843	13.739	66.061	79.800	0.030322	0.16690
25	39.310	24.614	0.011366	1.0039	87.981	0.99613	13.958	65.946	79.904	0.030772	0.16683
26	40.056	25.360	0.011380	0.98612	87.870	1.0141	14.178	65.829	80.007	0.031221	0.16676
27	40.813	26.117	0.011395	0.96874	87.760	1.0323	14.398	65.713	80.111	0.031670	0.16669
28	41.580	26.884	0.011409	0.95173	87.649	1.0507	14.618	65.596	80.214	0.032118	0.16662
29	42.359	27.663	0.011424	0.93509	87.537	1.0694	14.838	65.478	80.316	0.032566	0.16655
30	43.148	28.452	0.011438	0.91880	87.426	1.0884	15.058	65.361	80.419	0.033013	0.16648
31	43.948	29.252	0.011453	0.90286	87.314	1.1076	15.279	65.243	80.522	0.033460	0.16642
32	44.760	30.064	0.011468	0.88725	87.202	1.1271	15.500	65.124	80.624	0.033905	0.16635
33	45.583	30.887	0.011482	0.87197	87.090	1.1468	15.720	65.006	80.726	0.034351	0.16629
34	46.417	31.721	0.011497	0.85702	86.977	1.1668	15.942	64.886	80.828	0.034796	0.16622
35	47.263	32.567	0.011512	0.84237	86.865	1.1871	16.163	64.767	80.930	0.035240	0.16616
36	48.120	33.424	0.011527	0.82803	86.751	1.2077	16.384	64.647	81.031	0.035683	0.16610
37	48.989	34.293	0.011542	0.81399	86.638	1.2285	16.606	64.527	81.133	0.036126	0.16604
38	49.870	35.174	0.011557	0.80023	86.524	1.2496	16.828	64.406	81.234	0.036569	0.16598
39	50.763	36.067	0.011573	0.78676	86.410	1.2710	17.050	64.285	81.335	0.037011	0.16592
40	51.667	36.971	0.011588	0.77357	86.296	1.2927	17.273	64.163	81.436	0.037453	0.16586
41	52.584	37.888	0.011603	0.76064	86.181	1.3147	17.495	64.042	81.537	0.037893	0.16580
42	53.513	38.817	0.011619	0.74798	86.066	1.3369	17.718	63.919	81.637	0.038334	0.16574
43	54.454	39.758	0.011635	0.73557	85.951	1.3595	17.941	63.796	81.737	0.038774	0.16568
44	55.407	40.711	0.011650	0.72341	85.836	1.3823	18.164	63.673	81.837	0.039213	0.16562
45	56.373	41.677	0.011666	0.71149	85.720	1.4055	18.387	63.550	81.937	0.039652	0.16557
46	57.352	42.656	0.011682	0.69982	85.604	1.4289	18.611	63.426	82.037	0.040091	0.16551
47	58.343	43.647	0.011698	0.68837	85.487	1.4527	18.835	63.301	82.136	0.040529	0.16546
48	59.347	44.651	0.011714	0.67715	85.371	1.4768	19.059	63.177	82.236	0.040966	0.16540
49	60.364	45.668	0.011730	0.66616	85.254	1.5012	19.283	63.051	82.334	0.041403	0.16535
50	61.394	46.698	0.011746	0.65537	85.136	1.5258	19.507	62.926	82.433	0.041839	0.16530
51	62.437	47.741	0.011762	0.64480	85.018	1.5509	19.732	62.800	82.532	0.042276	0.16524
52	63.494	48.798	0.011779	0.63444	84.900	1.5762	19.957	62.673	82.630	0.042711	0.16519
53	64.563	49.867	0.011795	0.62428	84.782	1.6019	20.182	62.546	82.728	0.043146	0.16514
54	65.646	50.950	0.011811	0.61431	84.663	1.6278	20.408	62.418	82.826	0.043581	0.16509
55	66.743	52.047	0.011828	0.60453	84.544	1.6542	20.634	62.290	82.924	0.044015	0.16504
56	67.853	53.157	0.011845	0.59495	84.425	1.6808	20.859	62.162	83.021	0.044449	0.16499
57	68.977	54.281	0.011862	0.58554	84.305	1.7078	21.086	62.033	83.119	0.044883	0.16494
58	70.115	55.419	0.011879	0.57632	84.185	1.7352	21.312	61.903	83.215	0.045316	0.16489
59	71.267	56.571	0.011896	0.56727	84.065	1.7628	21.539	61.773	83.312	0.045748	0.16484
60	72.433	57.737	0.011913	0.55839	83.944	1.7909	21.766	61.643	83.409	0.046180	0.16479
61	73.613	58.917	0.011930	0.54967	83.823	1.8193	21.993	61.512	83.505	0.046612	0.16474
62	74.807	60.111	0.011947	0.54112	83.701	1.8480	22.221	61.380	83.601	0.047044	0.16470
63	76.016	61.320	0.011965	0.53273	83.580	1.8771	22.448	61.248	83.696	0.047475	0.16465
64	77.239	62.543	0.011982	0.52450	83.457	1.9066	22.676	61.116	83.792	0.047905	0.16460
65	78.477	63.781	0.012000	0.51642	83.335	1.9364	22.905	60.982	83.887	0.048336	0.16456
66	79.729	65.033	0.012017	0.50848	83.212	1.9666	23.133	60.849	83.982	0.048765	0.16451
67	80.996	66.300	0.012035	0.50070	83.089	1.9972	23.362	60.715	84.077	0.049195	0.16447
68	82.279	67.583	0.012053	0.49305	82.965	2.0282	23.591	60.580	84.171	0.049624	0.16442
69	83.576	68.880	0.012071	0.48555	82.841	2.0595	23.821	60.445	84.266	0.050053	0.16438
70	84.888	70.192	0.012089	0.47818	82.717	2.0913	24.050	60.309	84.359	0.050482	0.16434

SATURATION PROPERTIES OF FREON-12

Temperature, Deg. F.	Pressure, Lb. per Sq. In.		Volume, Cu. Ft. per Lb.		Density, Lb. per Cu. Ft.		Enthalpy, Btu per Lb.			Entropy, Btu per Lb. per Deg. Abs.	
	Abs.	Gage	Liq.	Vapor	Liq.	Vapor	Liq.	Latent	Vapor	Liq.	Vapor
70	84.888	70.192	0.012089	0.47818	82.717	2.0913	24.050	60.309	84.359	0.050482	0.16434
71	86.216	71.520	0.012108	0.47094	82.592	2.1234	24.281	60.172	84.453	0.050910	0.16429
72	87.559	72.863	0.012126	0.46383	82.467	2.1559	24.511	60.035	84.546	0.051338	0.16425
73	88.918	74.222	0.012145	0.45686	82.341	2.1889	24.741	59.898	84.639	0.051766	0.16421
74	90.292	75.596	0.012163	0.45000	82.215	2.2222	24.973	59.759	84.732	0.052193	0.16417
75	91.682	76.986	0.012182	0.44327	82.089	2.2560	25.204	59.621	84.825	0.052620	0.16412
76	93.087	78.391	0.012201	0.43666	81.962	2.2901	25.435	59.481	84.916	0.053047	0.16408
77	94.509	79.813	0.012220	0.43016	81.835	2.3247	25.667	59.341	85.008	0.053473	0.16404
78	95.946	81.250	0.012239	0.42378	81.707	2.3597	25.899	59.201	85.100	0.053900	0.16400
79	97.400	82.704	0.012258	0.41751	81.579	2.3951	26.132	59.059	85.191	0.054326	0.16396
80	98.870	84.174	0.012277	0.41135	81.450	2.4310	26.365	58.917	85.282	0.054751	0.16392
81	100.36	85.66	0.012297	0.40530	81.322	2.4673	26.598	58.775	85.373	0.055177	0.16388
82	101.86	87.16	0.012316	0.39935	81.192	2.5041	26.832	58.631	85.463	0.055602	0.16384
83	103.38	88.68	0.012336	0.39351	81.063	2.5413	27.065	58.488	85.553	0.056027	0.16380
84	104.92	90.22	0.012356	0.38776	80.932	2.5789	27.300	58.343	85.643	0.056452	0.16376
85	106.47	91.77	0.012376	0.38212	80.802	2.6170	27.534	58.198	85.732	0.056877	0.16372
86	108.04	93.34	0.012396	0.37657	80.671	2.6556	27.769	58.052	85.821	0.057301	0.16368
87	109.63	94.93	0.012416	0.37111	80.539	2.6946	28.005	57.905	85.910	0.057725	0.16364
88	111.23	96.53	0.012437	0.36575	80.407	2.7341	28.241	57.757	85.998	0.058149	0.16360
89	112.85	98.15	0.012457	0.36047	80.275	2.7741	28.477	57.609	86.086	0.058573	0.16357
90	114.49	99.79	0.012478	0.35529	80.142	2.8146	28.713	57.461	86.174	0.058997	0.16353
91	116.15	101.45	0.012499	0.35019	80.008	2.8556	28.950	57.311	86.261	0.059420	0.16349
92	117.82	103.12	0.012520	0.34518	79.874	2.8970	29.187	57.161	86.348	0.059844	0.16345
93	119.51	104.81	0.012541	0.34025	79.740	2.9390	29.425	57.009	86.434	0.060267	0.16341
94	121.22	106.52	0.012562	0.33540	79.605	2.9815	29.663	56.858	86.521	0.060690	0.16338
95	122.95	108.25	0.012583	0.33063	79.470	3.0245	29.901	56.705	86.606	0.061113	0.16334
96	124.70	110.00	0.012605	0.32594	79.334	3.0680	30.140	56.551	86.691	0.061536	0.16330
97	126.46	111.76	0.012627	0.32133	79.198	3.1120	30.380	56.397	86.777	0.061959	0.16326
98	128.24	113.54	0.012649	0.31679	79.061	3.1566	30.619	56.242	86.861	0.062381	0.16323
99	130.04	115.34	0.012671	0.31233	78.923	3.2017	30.859	56.086	86.945	0.062804	0.16319
100	131.86	117.16	0.012693	0.30794	78.785	3.2474	31.100	55.929	87.029	0.063227	0.16315
101	133.70	119.00	0.012715	0.30362	78.647	3.2936	31.341	55.772	87.113	0.063649	0.16312
102	135.56	120.86	0.012738	0.29937	78.508	3.3404	31.583	55.613	87.196	0.064072	0.16308
103	137.44	122.74	0.012760	0.29518	78.368	3.3877	31.824	55.454	87.278	0.064494	0.16304
104	139.33	124.63	0.012783	0.29106	78.228	3.4357	32.067	55.293	87.360	0.064916	0.16301
105	141.25	126.55	0.012806	0.28701	78.088	3.4842	32.310	55.132	87.442	0.065339	0.16297
106	143.18	128.48	0.012829	0.28303	77.946	3.5333	32.553	54.970	87.523	0.065761	0.16293
107	145.13	130.43	0.012853	0.27910	77.804	3.5829	32.797	54.807	87.604	0.066184	0.16290
108	147.11	132.41	0.012876	0.27524	77.662	3.6332	33.041	54.643	87.684	0.066606	0.16286
109	149.10	134.40	0.012900	0.27143	77.519	3.6841	33.286	54.478	87.764	0.067028	0.16282
110	151.11	136.41	0.012924	0.26769	77.376	3.7357	33.531	54.313	87.844	0.067451	0.16279
111	153.14	138.44	0.012948	0.26400	77.231	3.7878	33.777	54.146	87.923	0.067873	0.16275
112	155.19	140.49	0.012972	0.26037	77.087	3.8406	34.023	53.978	88.001	0.068296	0.16271
113	157.27	142.57	0.012997	0.25680	76.941	3.8941	34.270	53.809	88.079	0.068719	0.16268
114	159.36	144.66	0.013022	0.25328	76.795	3.9482	34.517	53.639	88.156	0.069141	0.16264
115	161.47	146.77	0.013047	0.24982	76.649	4.0029	34.765	53.468	88.233	0.069564	0.16260
116	163.61	148.91	0.013072	0.24641	76.501	4.0584	35.014	53.296	88.310	0.069987	0.16256
117	165.76	151.06	0.013097	0.24304	76.353	4.1145	35.263	53.123	88.386	0.070410	0.16253
118	167.94	153.24	0.013123	0.23974	76.205	4.1713	35.512	52.949	88.461	0.070833	0.16249
119	170.13	155.43	0.013148	0.23647	76.056	4.2288	35.762	52.774	88.536	0.071257	0.16245
120	172.35	157.65	0.013174	0.23326	75.906	4.2870	36.013	52.597	88.610	0.071680	0.16241
121	174.59	159.89	0.013200	0.23010	75.755	4.3459	36.264	52.420	88.684	0.072104	0.16237
122	176.85	162.15	0.013227	0.22698	75.604	4.4056	36.516	52.241	88.757	0.072528	0.16234
123	179.13	164.43	0.013254	0.22391	75.452	4.4660	36.768	52.062	88.830	0.072952	0.16230
124	181.43	166.73	0.013280	0.22089	75.299	4.5272	37.021	51.881	88.902	0.073376	0.16226
125	183.76	169.06	0.013308	0.21791	75.145	4.5891	37.275	51.698	88.973	0.073800	0.16222

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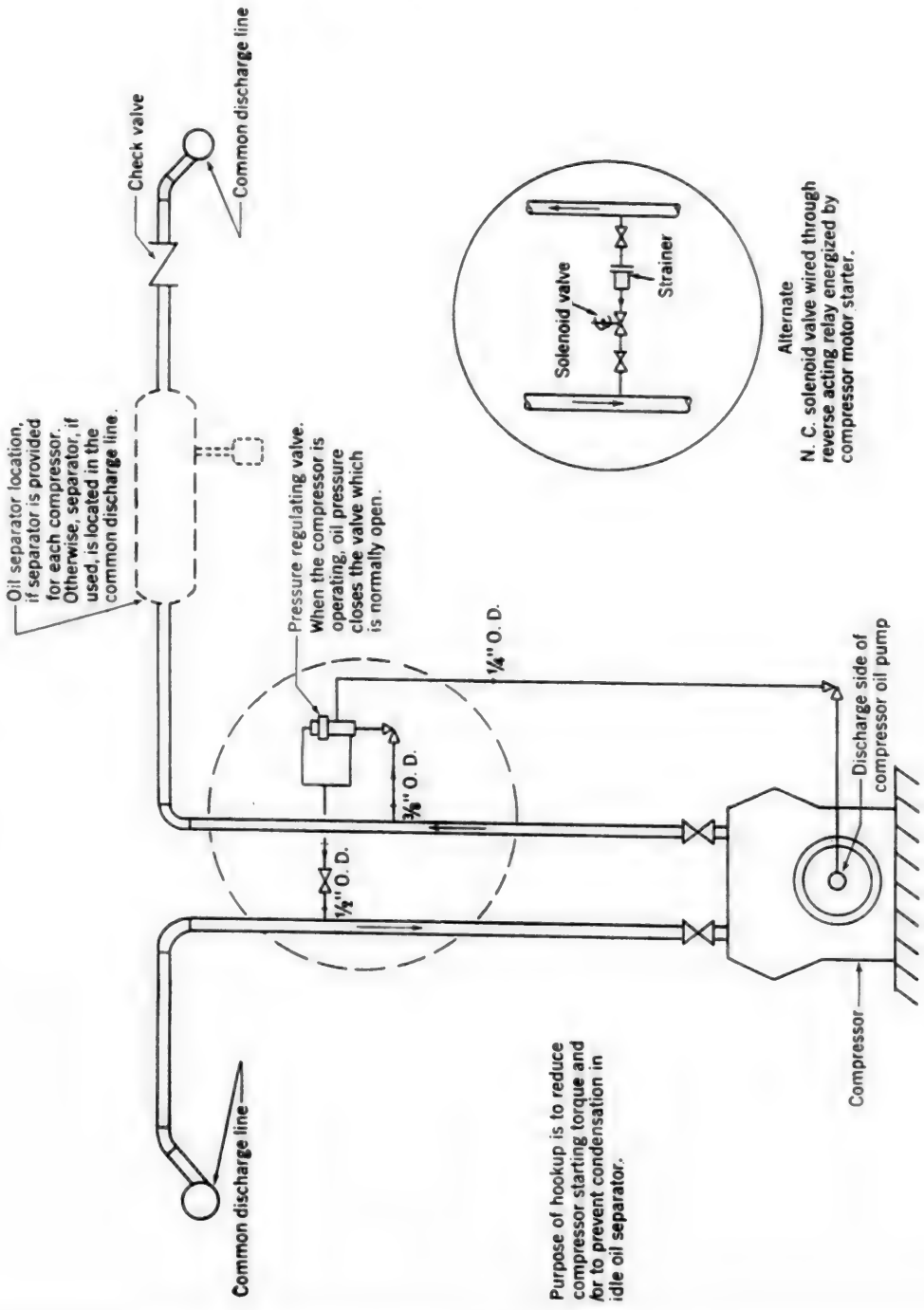
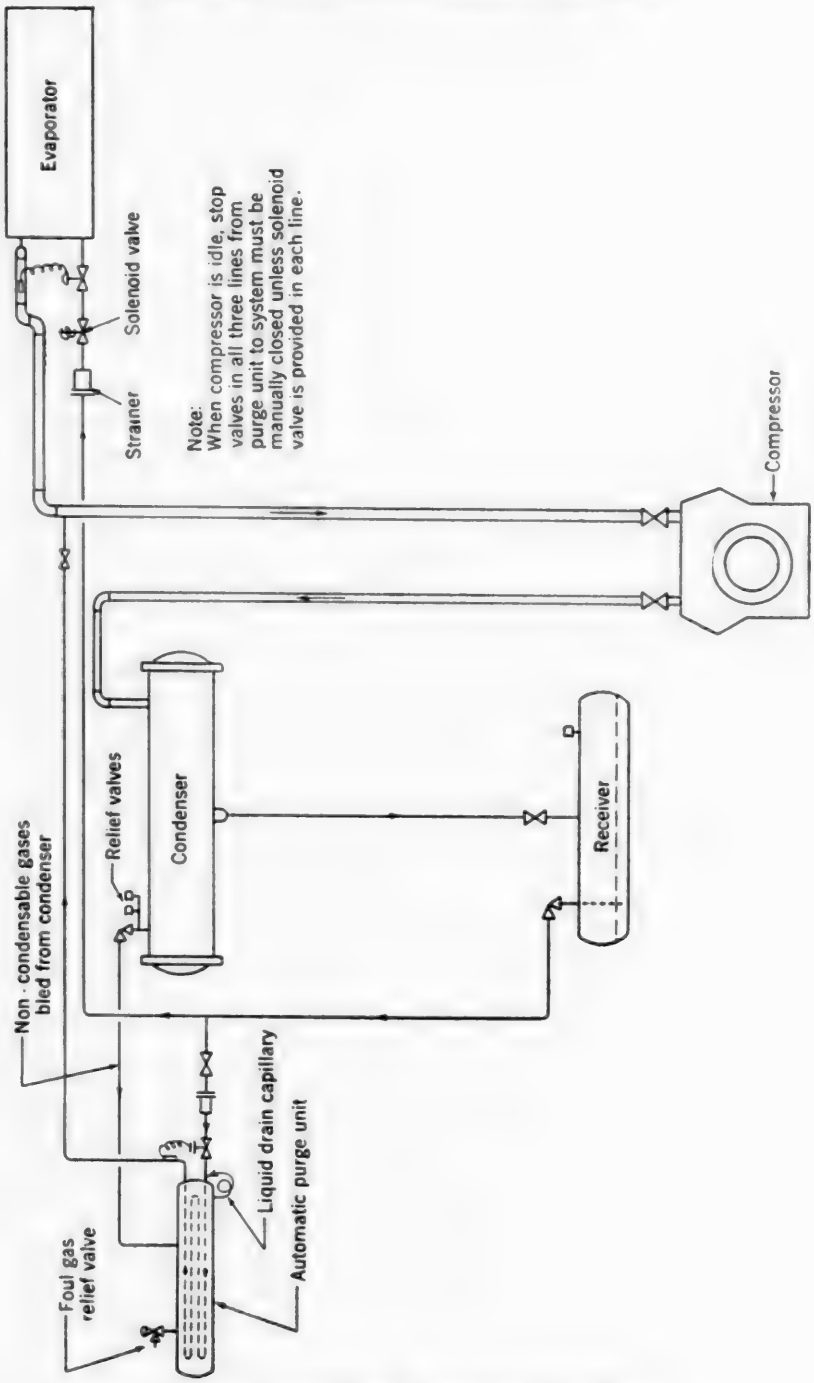
DISCHARGE LINE GAS EQUALIZATION FOR IDLE COMPRESSORS


Check valve
Common discharge line
Oil separator location, if separator is provided for each compressor. Otherwise, separator, if used, is located in the common discharge line.
Solenoid valve
Strainer
Alternate
N. C. solenoid valve wired through reverse acting relay energized by compressor motor starter.
Pressure regulating valve. When the compressor is operating, oil pressure closes the valve which is normally open.
¼" O. D.
⅜" O. D.
½" O. D.
Discharge side of compressor oil pump
Common discharge line
Purpose of hookup is to reduce compressor starting torque and for to prevent condensation in idle oil separator.
Compressor

AUTOMATIC PURGE UNIT PIPING FOR FREON REFRIGERANT


Evaporator
Solenoid valve
Strainer
Note:
When compressor is idle, stop valves in all three lines from purge unit to system must be manually closed unless solenoid valve is provided in each line.
Compressor
Relief valves
Condenser
Receiver
Non-condensable gases bled from condenser
Liquid drain capillary
Automatic purge unit
Foul gas relief valve

Drawings Presented Through Cooperation of York Corp., Subsidiary of Borg-Warner Corp., York, Pa.

Below and on the following pages are given brief digests of the advertisements appearing in this month's issue. Use this Digest to locate and refer to the advertisements in which you are particularly interested, then fill out and mail the prepaid postcard to request further information from manufacturers.

The items appear in the same order as the advertisements to which they refer, to facilitate obtaining further information after reading an advertisement. NOTE: All advertisements are digested here except those received too late for inclusion. The Index of Advertisers lists all the advertisements in this issue.

Use the postcard below for catalogs, new equipment and materials, as well as Ad-Digest items.

UNIT HEATERS. Inside front cover. Manufacturer's unit heaters feature fast start-up, high heating capacity, and compactness of design. Available for steam, hot water, and natural, manufactured, mixed, and L-P gas systems. Information is available. .....**Item 78**

INDUCED DRAFT CATALOG. Page 1. A new induced draft fan catalog with boiler ratings expressed in Btu per hr is offered by this manufacturer as a working tool for both the engineer and contractor. Included are tables and charts on volume of flue gas for oil, gas, and coal. Copies are available. .....**Item 79**

DRIP TRAP. Page 2. This manufacturer of thermostatic traps, radiator valves, dirt strainers, and process steam traps now offers a rugged, heavy duty drip trap for air and condensate removal in air conditioning coils, unit heaters, blast radiation, and hot water generators. Compact, light, they withstand 10 times the design pressure of 15 lb. Bulletin is available. **Item 80**

COPPER-LINED HEATER. Page 4. Company's copper-lined heater features rolled joints to allow for longitudinal expansion, an included vacuum breaker, and separate hydrostatic and pneumatic testing to provide long life and trouble-free service. Data are available. .....**Item 81**

WROUGHT IRON PIPE. Page 9. The maintenance-free operation provided since installation date by wrought iron pipe in five New York City buildings, ranging from 25 to 57 years old, is a dependable index to the material's low cost-per-year of service. Bulletin is available. ..**Item 82**

FLUSH VALVES. Page 11. The new $4,500,000 auditorium and coliseum in Charlotte, N. C., is fully equipped with this company's diaphragm type flush valves, several hundred in all. A hand book and catalog designed for everyday reference with 19 pages of installation details and over 75 blueprints is available. .....**Item 83**

HEAT EXCHANGERS. Page 13. This manufacturer of heat exchangers offers the results of experience, production facilities, materials testing, design research, and the guidance of its engineering staff, at the plant and in the field to provide practical solutions to heat exchange problems. Information is available. .....**Item 84**

MOTORS AND PUMPS. Page 14. Manufacturer features unit responsibility, national network of distributors and warehouse stocks for fast, dependable delivery of motors and pumps for air conditioning installations. Information, name of nearest distributor are available. .....**Item 85**

UNIT HEATERS. Page 15. One of this company's units will do the job of two or more old-style types, the clover-leaf 4-discharge pattern being adjustable to heating of square, L, T, and I-shaped areas. In 8 sizes, 55,000 to 600,000 Btu per hr, the largest will cover 104 sq ft of 136 ft corridor. Descriptive catalog available. .....**Item 86**

AUTOMATION IN AIR CONDITIONING. Between pages 16-17. The Supervisory Data Center is designed so that one man can operate a building's entire air conditioning system from a single panel. It eliminates need for manual floor-by-floor checking, gives central control on every floor, and provides better individual room thermostat control. Savings liquidate equipment cost. Information is available. .....**Item 87**

UNDERGROUND PIPE INSULATION. Page 17. The insulating efficiency, pipe protection, and high loading capacity of the manufacturer's underground pipe insulation made it an ideal choice for the Union Pacific Railroad's Omaha installation of over 9000 ft of underground steam and diesel oil lines. Details are available. .....**Item 88**

COPPER WATER TUBE. Page 18. Copper tube and copper solder-joint fittings made by this company were used in the snow removal system installed by a utility company. The tube comes in long lengths that are bent into position and require fewer joints. Tube and fittings expand and contract as one unit. Information is available. .....**Item 89**

ROLL-TYPE AIR FILTER. Pages 19 to 21. Dry-type filtering medium on roll has dust holding capacity of a viscous filter. Dust filled medium rolls away and fresh medium moves into place. Maintenance involves replacing soiled roll with a new one. Bulletin is available. .....**Item 90**

AUTOMATIC TEMPERATURE CONTROL. Pages 22-23. In a modern 23-story building in Denver, Colo., the manufacturer's system of automatic temperature control coordinates the operation of all heating, cooling, and ventilating equipment to limit output to actual needs. Information is available. .....**Item 91**

HEATING-VENTILATING UNIT. Pages 24-25. Manufacturer announces a new line of heating-ventilating units which deliver a large volume of filtered, uniformly heated air. Units feature quiet operation, wide operating range, long life, and low cost. Information is available. .....**Item 92**

TEMPERATURE CONTROL SYSTEM. Pages 26-27. Manufacturer's temperature control system installed in 1915 in high school of Highland Park, Ill., provided dependable service. As a result, new high school uses the company's equipment to regulate temperature of forced hot water supply to convectors under thermostatic control. Information is available. .....**Item 93**

GALVANIZED DUCT STEEL. Pages 28-29. Six sheet metal contractors throughout the Middle West comment on the advantages of this company's galvanized sheet steel for duct work. The continuous galvanizing process eliminates the brittle iron-zinc layer that causes galvanized coatings to flake. .....**Item 94**

CUSTOMIZED TEMPERATURE CONTROL. Pages 30-31. The manufacturer's system of custom temperature control was applied to a new hospital in Boonton, N. J., providing year-long satisfaction of individual indoor weather needs. Information is available. .....**Item 95**

Circle numbers corresponding to the items and advertisements in which you are interested, print your name and address clearly. Information will be sent directly from manufacturers.

INQUIRY CARD

Circle below item numbers on which you wish catalogs or further information.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
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PLEASE PRINT Nov. H-56

This service available only to U.S. and Canadian readers.

Name .....

Firm .....

Nature of Firm's Business .....

Street .....

City .....**Zone** ....**State** .....

This card is void after Feb. 1, 1957

Ad-Digest

CENTRAL AIR CONDITIONER. Page 32. The manufacturer's central air conditioning system consisting of packaged liquid chiller and condensing unit for a Florida motel has proved so effective that a second central system is being ordered for a new construction. Bulletin is available. .....**Item 96**

BELT DRIVE ROOF EXHAUSTER. Page 34. Manufacturer has power unit completely isolated from base of roof exhauster to eliminate vibration and sound transmission. Available in a range of sizes to 24,000 cfm. Information is available. .....**Item 97**

PACKAGED AUTOMATIC BOILERS. Page 36. The architects and builders of a modern New Jersey inn chose two of the manufacturer's packaged automatic boilers for efficient and dependable heating as well as compactness of design. Bulletin may be obtained. .....**Item 98**

COPPER TUBE AND PIPE. Page 37. Manufacturer's production system for seamless copper tube and pipe is completely integrated so that quality control may be applied from raw material to packaged tube. Information is available. ...**Item 99**

HEATING, VENTILATING EQUIPMENT. Pages 38-39. The manufacturer's complete line of heating and ventilating equipment was utilized in the planning of a new automatic transmission plant at Kokomo, Ind. Catalogs describing the items in the line may be obtained. .....**Item 100**

AIR CONDITIONING SYSTEM. Page 40. Manufacturer teams up with consulting engineer and contractor to air condition Philadelphia's Convention Hall. Resulting system provides indoor comfort for a million people per year. Information is available. .....**Item 101**

RENEWABLE COMPOSITION DISCS. Page 41. The only manufacturer of both valves and discs remains the leader in composition disc development and production since 1864. Guide for disc selection available describing applications for steam, hot and cold water; air, gas, oil, gasoline, and a new model for control of oxygen and other gases; solvents, acids, alkalies, and other chemicals .....**Item 102**

MODERN COAL BURNING. Page 43. Many industries such as Bendix Aviation Corp. of South Bend, Ind., are burning coal the modern way and finding fuel and maintenance costs down, efficiency and availability up. Qualified engineering firms can provide the latest information on fuel costs and equipment. Additional case histories of modern, coal-burning installations are available. .....**Item 103**

STEEL PIPE. Page 44. Uniform threading of this company's pipe makes jobs easier and quicker. Couplings, tees, and elbows can be put on smoothly and tightened up to form a leakproof joint. Information is available. .....**Item 104**

HEATING SYSTEM CONTROL. Page 45. Centralized controlled adjustment of vacuum or pressure automatically adjusts heat medium to balance with varying heat loss of a building due to changing outside weather conditions. Bulletin is available. .....**Item 105**

AIR-COOLED CONDENSERS. Page 46. A remote air-cooled condenser has been devised by this company for simpler multiple circulating. The condenser's tubing assembly is self-reinforcing, locking out vibration before it starts. Bulletin is available. .....**Item 106**

AIR MIXERS AND DIFFUSERS. Page 47. An acoustically lined chamber made by this company blends the hot and cold air supplied to it at 3500 to 6000 fpm. The air then passes through an air diffuser where it is mixed with room air to the desired temperature. A new products bulletin and selection manual are available. **Item 107**

HYDRO-STATIC PRECIPITATOR. Page 48. The manufacturer's hydro-static precipitator offers high collection efficiency on heavy concentrations of coarse and fine particles in high temperature exhaust gases associated with rotary kiln operation. An example is installation of two rotary kilns at Modesto, Calif., for processing barite ore. Bulletin is available. .....**Item 108**

REGISTERS AND GRILLES. Page 49. This company's line of registers and grilles includes perimeter baseboard diffusers, perimeter baseboard registers, perimeter floor registers, and ceiling air diffusers. Catalog is available. .....**Item 109**

YEAR-ROUND AIR CONDITIONERS. Page 50. Chicago's Edgewater Beach hotel has replaced old fashioned radiators with this company's tasteful, space-saving units which heat with existing steam or hot water and cool with their own efficient cycle, resulting in a thermostatically controlled heating and cooling system in each room. 1-hp cooling cycle uses no water, costs half as much to install, 20% less to operate. Information available. ..**Item 110**

REFRIGERANTS. Page 51. A line of refrigerants is offered by this company that is low in moisture content and interchangeable with comparable fluorinated hydrocarbon refrigerants produced by other manufacturers. A folder with pressure and temperature charts is available. .....**Item 111**

ELECTRIC MOTORS. Page 52. This line of electric motors features corrosion-resistant cast iron frames with the motor feet cast as an integral part of the frame. Enclosures are drip-proof. The motors are engineered to meet the re-rated NEMA specifications for smaller frames. Information and dimensions are available. .....**Item 112**

AIR-COOLED CONDENSER. Page 53. Remote-type, air-cooled condensers are now made by this company for big tonnage air conditioning systems. One is mounted on a supermarket roof and is used with a 100-ton system. Bulletin is available. .....**Item 113**

AIR HANDLING EQUIPMENT. Page 54. This company's line includes power roof ventilators, blowers, furnace fans, unit heaters, propeller fans, universal blowers, air conditioning units, and ventilating sets. Bulletins are available describing each of the categories. .....**Item 114**

GALVANIZED STEEL SHEET. Page 55. This company has developed ductile, tight-coated galvanized steel sheet suitable for spinning into shapes such as recessed ceiling light reflector housing. Material will not chip, crack, flake, or peel. Information is available. .....**Item 115**

FANS AND BLOWERS. Page 56. Fans and blowers are made by this company to power any ventilating system. Duct fans are available in sizes from 12 to 60 in., and bypass duct fans from 19 to 41 in. Vaneaxial blowers are available from 18 to 42 in. Bulletins are available. **Item 116**

STEEL PIPE. Page 58. Over 7,000 ft. of ¾-in. steel pipe were used in the snow melting system, alone, of a new life insurance building. Steel pipe was also installed for the hot water heating system. Information is available. ....**Item 117**

HEATING, COOLING EQUIPMENT. Page 59. The manufacturer offers a wide variety of heating and cooling equipment including combination heating-cooling units, water chillers, unit heaters, and radiant and warm air baseboards. Information is available describing this line. ...**Item 118**

PACKLESS VALVE. Page 60. This valve is packless and leakproof due to the feature of a metal-to-metal seal between a collar machined on the valve stem and stainless spring steel wafers which fit tightly on the stem and press against the collar. Furnished in wide range of patterns. Information is available. .....**Item 119**

FORCED DRAFT BURNER UNIT. Page 61. Manufacturer packages oil, gas, or combined fuel burner, factory-wired control panel, forced draft air supply, and built-in fuel system as one integrated unit ready for fitting to boiler. Information is available. .....**Item 120**

CENTRIFUGAL FANS. Page 62. Made in two types, standard and heavy duty. Housing dimensions the same but have different performance characteristics. Forward curve wheels from 7½ to 73 inches. Quiet operating, medium speed wheels with wheel diameters from 15 to 73 inches. Line features all welded housing. Bulletins available. .....**Item 121**

PLUG-TYPE VALVE SEATS, DISCS. Page 64. Manufacturer offers four lines of bronze globe valves with stainless steel, plug-type seats and discs which are machined and fitted simultaneously for perfect mating. Deep stuffing boxes with a gland permit valves to be repacked under pressure. Illustrated circular is available. ..**Item 122**

Postage Will be paid by Addressee

No Postage Stamp Necessary If Mailed in the U. S.

BUSINESS REPLY CARD

FIRST CLASS PERMIT NO. 53, SEC. 34.9, P. L. & R., NEW YORK, N. Y.

AIR CONDITIONING, HEATING AND VENTILATING

93 WORTH STREET

NEW YORK 13, N. Y.

AD-DIGEST SERVICE

Ad-Digest

PIPE RACKING CHANNELS. Page 65. A method of pipe racking is offered by this company with six channels, clamps, hangers, concrete inserts, rollers, and other accessories. No drilling, welding, or riveting is required for supporting steam, gas, light conduit, air conditioning, or heavy water lines. A 78-page catalog is available. .....**Item 123**

STEAM HUMIDIFIERS. Page 67. A practical answer to central humidification is offered by this company with its steam humidifier that is connected to discharge into ducts or plenum chambers. Three sizes are available with capacities ranging from 25 to 1280 lb of steam per hr. Selection, installation, and price data are available. .....**Item 124**

AIR FILTERS. Page 68. This company's engineers will test your filter bank under your operating conditions to prove to your satisfaction that you get reasonable first cost and lower maintenance costs for many years, more air at less pressure loss, and the finest quality air filters. Detailed information is available. .....**Item 125**

SOUND TRAPS. Page 69. Sound traps are made by this company to silence air conditioning noise of all frequencies in the audio-frequency range. A 7-ft unit suppresses as much sound as 100 ft of ordinary duct lining. Four series cover applications ranging from offices to recording studios. Booklet is available. .....**Item 126**

VANEAXIAL-TYPE FANS. Page 70. Aerodynamic blades with close tip tolerance plus internal vanes which convert rotative air energy to velocity and pressure, save power. Designed for installation in the duct, saving space and installation expense. Bulletin is available. .....**Item 127**

PUMP LINE. Page 71. A line of pumps is manufactured by this company which covers any type of heating requirement. A bulletin on each type of pump in the line is available. .....**Item 128**

THERMOSTATIC CONTROL VALVES. Page 72. A one degree variation in the temperature of the steam in a heating circuit, of liquid in cooling systems and recirculating lines or in the mixture of hot and cold liquids will actuate this company's temperature regulators with non-ferrous hydraulically formed bellows for instant response and polished stainless steel valve stem. .....**Item 129**

REVOLVING HEATERS. Page 73. Revolving-type unit heaters place every worker in the comfort zone in a large airplane factory in Seattle, Wash. And, in summer, with steam supply off, the revolving distributors produce pleasant cooling effect. Bulletin is available. .....**Item 130**

TEMPERATURE REGULATORS. Page 74. The advantages of packless construction in temperature regulating valves include the elimination of repacking problems, lower maintenance, and accuracy of regulation. This company's temperature regulators are guaranteed not to wiredraw. A bulletin with piping layouts is available. .....**Item 131**

DRAFT CONTROLS. Page 75. This company's draft controls provide both precision and strength. Available in Type M, 6 to 32 inches, for oil and coal plants; type MG, 8 to 32 inches, for gas fired plants; and type RC, 6 to 9 inches, for domestic oil and coal fired plants. Information available. .....**Item 132**

STEAM TRAPS. Page 77. Quick delivery and proven durability are reasons why the manufacturer's steam traps comprise 95% of the steam traps in the Elkhart, Indiana, school system. Bulletin is available. .....**Item 133**

GLASS FIBER INSULATION. Page 78. Insulation application time was reduced 20% in one plant because this company's fiber glass insulation is held in place with adhesive. Its light weight characteristics make it easy to handle. Consultation on insulating problems is offered. ...**Item 134**

LIQUID LEVEL CONTROL. Page 79. The combination of the manufacturer's thermostatic expansion valve and element bulb insert provides positive liquid level control of flooded systems for Ammonia and Freon 12 up to 100 tons, and for Freon 22 up to 180 tons. Bulletin is available. .....**Item 135**

STEAM BOILERS. Page 141. Boilers manufactured by this company provide steam for air conditioning and heating a large office building. Boilers are available in standard sizes to 40,000 lb per hr of steam at pressures to 235 psi. Bulletin is available. .....**Item 136**

ELECTRIC-ELECTRONIC CONTROLS. Page 143. Fast, positive response at settings on legibly marked dials characterizes this company's automatic temperature control apparatus. Compensating elements anticipate load changes, prevent controls from hunting or lagging. Tamperproof sensing elements may be located anywhere, connected to conveniently located control center. Wide variety of equipment sequencing possible. Information available. .....**Item 137**

TOTALLY ENCLOSED MOTORS. Page 145. These cast frame motors have external and internal fans for high cooling efficiency. Tightly sealed openings provide complete protection to windings and working parts. Over-all cost compares favorably with that of open types. Booklet available. .....**Item 138**

EXPANSION JOINTS. Page 147. Manufacturer's expansion joints feature repacking under full steam pressure, low maintenance costs, long service life, and need of fewer joints per length of pipe line. Bulletin may be obtained. .....**Item 139**

PRESSURE BURNER. Page 149. This company's burner looks like a residential type but is a heavy duty machine firing efficiently into combustion chamber pressures of 3 in. or more. Fuel is oil, gas, or both. Data sheets are available. .....**Item 140**

STEAM DISTRIBUTING TUBES. Page 149. Uniform temperatures across its surface under modulated steam supply is assured by the design of this company's distributing tubes, resulting in uniform discharge temperatures, maximum freeze protection, and perfect control. Bulletin is available. .....**Item 141**

SNAP-ON PIPE INSULATION. Pages 150-151. This glass fiber pipe insulation is lightweight, resilient, and rugged; virtually unbreakable for quick, easy application; has high thermal efficiency up to 350 deg F; is permanent yet re-useable; and is available in 3 or 6 ft sections in sizes up to 33 in. Distributors are listed. .....**Item 142**

PIPE FITTINGS. Page 152. Pipefitter in advertisement likes this manufacturer's fittings because of full, clean threads, chamfered entrances, and strong, uniform walls. Catalog is available. .....**Item 143**

GAS FIRED SPACE HEATERS. Page 153. Replacement of hand-fired coal stoves with this company's gas fired forced air counterflow heaters provided welcome comfort to Ohio electrical manufacturing plant's personnel, freeing 3400 sq ft of floor space and annually saving $6732 gross. Information available. ...**Item 144**

CONVERTIBLE GAS UNIT HEATERS. Page 154. Low-cost kits are available for 5-10 minute conversion of this company's gas unit heaters from natural to LP, LP-air, or mixed gas, so that your jobber can always supply your need without waiting for shipments from the factory. Bulletin available. .....**Item 145**

VENTILATORS. Page 155. The ventilators offered by this company have gone through several wind tunnel design stages to insure their performance under operational conditions. Engineering performance data on the line of ventilators are available. .....**Item 146**

REFRIGERATING EQUIPMENT. Page 155. Nine of this company's compressors carry the air conditioning load, divided into three systems, for the first completely air-conditioned large hotel in the North, the Claypool at Indianapolis. Ice-making and quick freezing equipment also offered. Information available. .....**Item 147**

STEAM TRAP. Page 156. Steam trap features open float and thermostatic design combination for quick heat-up of steam-using production units. Trap has straight-through design for simplified installation. Bulletin is available. .....**Item 148**

Circle numbers corresponding to the items and advertisements in which you are interested, print your name and address clearly. Information will be sent directly from manufacturers.

INQUIRY CARD

Circle below item numbers on which you wish catalogs or further information.

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PLEASE PRINT Nov. H-56

This service available only to U.S. and Canadian readers.

Name .....

Firm .....

Nature of Firm's Business .....

Street .....

City .....**Zone** ....**State** .....

This card is void after Feb. 1, 1957

Ad-Digest

CABINET UNITS. Page 157. There are twenty variations in design of this company's line of cabinet units for heating or cooling with hot or chilled water, with or without ducts, in sizes ranging from 120 to 640 EDR mounted in floor, wall, or ceiling. Bulletin is available. ..**Item 149**

COOLING TOWERS. Page 158. Company's cooling towers have high cooling efficiency under all climatic conditions. All parts are designed for easy erection and access. Towers have a minimum maintenance record with three Flint, Michigan, department stores. Bulletins are available. .....**Item 150**

ICE BANKS. Page 159. Sweet water ice banks are designed by this manufacturer to deliver tons of 32 to 34-deg F ice water for recirculation through air cooling coils in air conditioning systems. Designed for use with Freon, methyl chloride, or ammonia, the banks may be added to existing systems for increased capacity. Catalog is available. .....**Item 151**

AIR DIFFUSERS. Page 160. The complete line of air diffusers offered by this company meets all requirements for cooling, cooling and heating, and supply and return. They are adjustable, and are available in a wide variety of shapes. Catalog may be obtained. .....**Item 152**

HEATERS-COOLERS. Page 161. The line of U-bend heaters and coolers made by this company includes: tank suction heaters, oil pre-heaters, condensate coolers, storage water heaters, and instantaneous water heaters and convertors. Information is available. .....**Item 153**

AIR RECOVERY. Page 161. To prevent beer from being affected by polluted air, a brewery installed this company's air recovery system to provide pure uncontaminated air. The air recovery system can also reduce costs of air conditioning and ventilating systems. Information is available. .....**Item 154**

HUMIDITY CONTROL. Page 162. The manufacturer's method of humidity control provides more effective air conditioning because cooling and heating functions are made separate from adding or taking away of moisture. Two bulletins which describe system are available. ..**Item 155**

ROOF VENTILATORS. Page 163. Forty-nine 48-in. aluminum low-type roof ventilators are used to maintain a pleasant working atmosphere and remove oil mist from a screw machine products plant with 200,000 sq ft of floor space. Twenty-five of the ventilators supply air; the remainder function as exhaust ventilators. Ventilating databook is available. .....**Item 156**

CONTROL VALVES. Page 163. This company's valves insure control of water, steam, gas or oil. They are engineered, designed and manufactured to the standards of the industry. The valves are made in a complete line of bronze and iron bodies. The valves were recently installed in a modern office building. Brochure available. .....**Item 157**

BOILER WATER LEVEL CONTROL. Page 164. Boiler water level control uses simple magnetic system for safe, low maintenance operation. Available for pressures to 600 psi and temperatures to 750 deg F. Catalog is available. .....**Item 158**

FLEXIBLE DUCT CONNECTORS. Page 165. Flexible duct connectors are made by this company in one-piece, factory-assembled, metal-to-material units that unroll flat. A choice of canvas, asbestos, and neoprene-coated fiber glass is offered attached to galvanized steel or aluminum in 25, 50, or 100-ft rolls. Catalog and specification sheet are available. .....**Item 159**

AIR DIFUSERS. Page 165. Square and rectangular air diffusers are equipped by this manufacturer with built-in diffusing vanes arranged in unlimited louver patterns. A catalog showing how to select the proper size and pattern for particular job conditions is offered by the company. .....**Item 160**

VENTILATION MANUAL. Page 166. The fourth official edition of an industrial ventilation manual has been enlarged, improved, and includes many new tables. It contains the information needed for the design of industrial ventilation systems. .....**Item 161**

WASHABLE AIR FILTER. Page 167. This life-time, electrostatic air filter has a plastic-fabric medium. Dust and dirt can be washed out under faucet returning fabric to original white color. No application is required, and filter outlasts 50 of the throw-away type. Details are available. .....**Item 162**

MAKE-UP AIR UNITS. Page 167. Make-up air units are designed to supply ample quantities of clean, pre-heated air for maintaining peak exhaust fan performance, reducing infiltration drafts, and stabilizing heating loads. Available in seven unit arrangements. Bulletin is available. .....**Item 163**

PRODUCT COOLERS. Page 167. Product coolers are available for any given temperature needs, for both wet and dry operation. Water and hot gas defrost can be furnished in addition to custom engineered units. Catalog is available. .....**Item 164**

AIR CONDITIONING EQUIPMENT. Page 168. One of seven complete lines of year-round air conditioning equipment offered by this manufacturer includes recessed room units and recessed console models. Literature is available. .....**Item 165**

AIR DUCT HEATERS. Page 169. Controlled temperatures to 1000 deg F can be maintained by electric air duct heaters for heating air and gases under forced circulation. Installed in round or rectangular ducts, the heaters may be used for drying, curing, baking, and annealing ovens. Catalog is available. .....**Item 166**

HEATERS. Page 169. Direct fired, warm air heaters are made by this company in a full range of sizes for gas, oil, or gas-oil firing. A gas-fired, infra radiant heater is also made by the company for commercial and industrial heating. Bulletins are available. .....**Item 167**

ALUMINUM EXHAUSTERS. Page 169. A bulletin on spun aluminum exhausters is offered by this manufacturer with facts about centrifugal roof and wall mounted exhausters as well as axial flow units. Performance tabulation for both direct and V-belt driven units are available throughout the range of sizes. .....**Item 168**

ALL-METAL SHUTTERS. Page 171. All-metal shutters of wide variety for commercial, industrial, residential, and institutional installations are available from this company. Feature strength and durability. Circular may be obtained. .....**Item 169**

AIR METER. Page 171. Air conditioning, heating, and ventilating systems are accurately balanced with this company's air meter. Air velocity, temperature, and static pressure indicated in response to color-coded pushbuttons. Bulletin available. .....**Item 170**

INTERIOR FIRE PROTECTION. Page 171. Interior fire protection equipment is offered by this manufacturer with accurate quotations from its factory, delivery as promised, and quick installations. The company makes an entire line of equipment. Information is available. .....**Item 171**

RADIANT CEILING. Page 172. A radiant acoustical ceiling provides, in one integrated unit heating, cooling, ventilaton, humidity control, noise reduction and lighting. Booklet with details and design data available. .....**Item 172**

WING CAP VALVES. Inside back cover. Semi-steel, wing cap valves are made by this company with five types of connections: FPT in valve butt; OD soldered brass adapter and steel flange; steel butt weld adapter and steel flange; one piece FPT flange; and one piece slip-on weld flange. Information is available. **Item 173**

BOILER WATER LEVEL CONTROLS. Back cover. Advertisement illustrates point of the wasted dollars involved in the manual control of boiler water level. Information is available. .....**Item 174**

Postage Will be paid by Addressee

No Postage Stamp Necessary If Mailed in the U. S.

BUSINESS REPLY CARD

FIRST CLASS PERMIT NO. 53, SEC. 34.9, P. L. & R., NEW YORK, N. Y.

AIR CONDITIONING, HEATING AND VENTILATING

93 WORTH STREET

NEW YORK 13, N. Y.

AD-DIGEST SERVICE

Consulting Engineers Tighten Mechanical Specifications

HARRY TERRY

Chairman, Public Relations Committee,
New York Association of Consulting Engineers

MEMBERS of the New York Association of Consulting Engineers during the past thirty years have each prepared his own supplementary Mechanical and Electrical General Conditions to be used with the American Institute of Architects General Conditions for the Construction of Buildings. During the past two years a committee of NYACE has reviewed these individual practices and compiled a set of Conditions representing the combined experience of its members.

These *Conditions* apply to specifications covering all mechanical trades, such as Heating, Plumbing, Air Conditioning and Electrical Work, specifications for which can be divided into the three following general classes:

(1) The *Open* specifications in which minimum standards of quality and performance are set forth, and by which any piece of equipment or material which complies with these minimum standards is acceptable. This type of specification is most commonly found in U. S. Government work.

(2) The *Bidder's Choice* specification in which three or more brands of any given piece of equipment usually are named and described, the choice being left with the bidder. This is the most common of all types of specifications in use today, particularly on public work.

(3) The *Base Bid* specification in which various items of equipment are concisely described, their performance defined, and the manufacturer's name and catalog designation clearly set forth. In this type of specification, the base bid includes only the articles specifically named, and if other brands of equipment are offered, they are included as an alternate proposal.

The *Open* specification enables the specifying engineer to maintain complete impartiality among equipments or materials made by various manufacturers and suppliers of equipment. This type of specification should present complete and comprehensive detail on each item. Specifications for a heating unit, for example, should include heat exchange, heating surface, entering and leaving air temperatures to establish the capacity characteristics and equally comprehensive details of the materials of the coil, method of fabrication, sealing of connections, as well as specific data on fins, tubes, headers and tappings. Cabinet enclosures are similarly described. Motors required are described as to electrical characteristics, drive, speed, guards, and motor mount. Even greater detail may be set up for control apparatus.

Standard general conditions must be written to cover all three types of specifications and since so much choice may be left to the contractor, he must accept corresponding responsibility.

From the bidder's point of view, a loose specification does admit bargaining between various suppliers. However, since basic plans cannot be complete in detail, indeterminate items can be specifically defined only after the selection of equipment is approved by the specifying engineer.

From the craftsman's point of view, such a specification is most undesirable because the basic plans are necessarily lacking in detail. Detailed plans prepared by the manufacturer of the equipment are concerned only with the immediate problems of a particular piece of equipment. The foreman on the job and the clerk-of-works must fit the selected apparatus in the building without conflict between various trades.

From the owner's point of view, the major objection to a loose open specification is that the lack of precise definition in specifications may result in numerous extras which often work a severe handicap in financing.

The *Bidder's Choice* specification is an open specification which limits the contractor's choice of equipment to two or three brands, predetermined to be acceptable to the designer. The objections to an open specification are also present in this type of a specification but they are more limited in scope and create proportionately less of a problem to all concerned. It is true that less technical detail and description are required than with an open specification but it is also true that architectural plans and layouts must be prepared with enough latitude to allow for variations in equipment.

The *Base Bid* type of specification, where each item of equipment is clearly defined as to quality, capacity, function and performance and specifically identified with the manufacturer's name, model number, catalog listing and size designation, gives the bidder no choice of equipment under his base bid. All contractors bid on the named equipment and the only variable factors involved are quantities of miscellaneous supplies and quantities of labor. The architect and owner know exactly what will be received for a given cost. The kind or brand of equipment that will be used is *not* within the province of the contractor but rests jointly in the hands of the architect, engineers and owner, where it rightfully belongs. If there are price differentials, the owner receives or pays the difference as the case may be, if he chooses to accept alternate proposals. If acceptance of an alternate will require design changes, extra costs on the part of other trades, or additional engineering, costs of these changes can be established and a true evaluation can be made on the worth of an alternate proposal, prior to its acceptance by the owner.

The mechanical and electrical specifications prepared in New York City are of the three general classes listed in the foregoing, and the general conditions for these specifications must of necessity be broad enough to apply to all three classes. Paragraph 2 of the General Conditions, therefore, frankly demands that "It is the intention of the Specifications and Drawings to call for finished work tested and ready for operation, ... and that the Contractor has included the cost of all required items in his proposal, and that he will be responsible for the approved satisfactory functioning of the entire system without extra compensation."

The most vulgar objection to broad coverage specifications and General Conditions is sometimes expressed in the damning statement that such specifications contain "God Save Us All" clauses. However, any specification must be set up to protect the owner, the legitimate bidder, the supplier, the architect and the engineer against unfair and unethical practices, including the following:

(1) Failure of successful bidder to place orders promptly for the required equipment. One contractor, instead of placing his order for equipment, promptly will indulge in shopping between the suppliers of various brands. He will play one against the other until, finally, the supplier who does obtain the order is more unfortunate than any of his competitors. First of all he has had to cut his price to a point where he no longer has a profit. Second, his selling expense has doubled and sometimes tripled. Third, while all this shopping has been going on, time has been passing and invariably delivery is delayed. In most cases a manufacturer will not extend himself too much to expedite a non-profit order. This condition then provides a hand made opportunity for the contractor to attempt a substitution to his own advantage.

(2) Increasing the engineer's cost of doing business. The technical performance and quality of substitute brands must be checked carefully for each unit offered for consideration, in order to determine if the units proposed will meet the minimum requirements of the specifications. This work is time consuming and therefore costly.

There has been little constructive accomplished by this byplay, for the engineer, supplier or owner. As far as the contractor is concerned, job delay probably eats up any additional profit obtained through these manipulations of orders and specifications.

A fallacious objection to tight specifications is that they require the bidder to accept responsibility for work the engineer has been paid for and for which he should himself take the responsibility. This familiar objection has been advanced most strongly by wartime contractors. Their experience with the Corps of Engineers, which depended upon renegotiation of contracts to protect the government from overcharging, has encouraged the practice of making a low bid and depending on extras to make the work profitable.

Failure of many architects and engineers to recognize the importance of insisting that owners be protected against such practices has resulted in a new clause in the New York City Housing Authority's standard contract with architects. It reads as follows:

"*Responsibility of Architect.* The Architect shall apply to the preparation of the plans and specifications the reasonable and proper skills, judgment, and care which are customary and normal to professional architectural practice, and shall be liable to the Local Authority for damages or losses resulting from failure to apply the above reasonable and proper skills, judgment and care."

This clause makes it imperative that plans and specifications be such as will leave no opening for a contractor to charge the architect or engineer with accountability for errors and omission presumably to be paid for by the owner without making the architect or engineer actually responsible for the cost to the owner of such errors and omissions.

Years of experience in all branches of construction show conclusively that the best contractors welcome a tight specification, provided it is enforced as rigidly as it is written. Such contractors will not deviate from or attempt to evade a well written specification. When others do attempt to do so, the architect and engineer should be totally inflexible and should insist on compliance with both the letter and the intent of the contract specifications or else be personally responsible for their failure to do so.

The General Conditions described here include the following topics: intent, approvals, equipment deviations, codes, rules, permits, fees, surveys, drawings, cooperation of trades, scaffolding, excavating, material, workmanship, motors, quiet operation, accessibility, patching, foundations, shop drawings, tests, operating instructions, and guarantee. Elective paragraphs are those on bidder qualifications, as-built drawings, unit prices, payment for facilities, progress charts, union regulations, guards and railings, and temporary facilities.

Supporting Insulation Blocks

There are three types of anchors which can be employed to attach block-type thermal insulation to under and vertical sides of vessels and breechings, and on conical or convex surfaces, according to the Magnesia Insulation Manufacturers Association. These are: continuous angle irons, spot anchors (such as clips and hex nuts) and welded studs or pins.

Continuous angle irons are employed most frequently on cylindrical vessels of large diameters. On horizontal tanks, for example, the angle irons are welded to the underside and spaced 120 deg apart, equally distant from the bottom center. Insulation blocks are secured by metal bands affixed to holes previously drilled in the projecting angle iron. Six bands per 3-ft insulating block are recommended for the lower third of the tank, and three bands per block for the rest of the circumference.

On large vertical vessels, angle irons are welded vertically at intervals, of approximately 20 ft and insulating blocks are secured with bands in the same manner, three bands per block. Depending on the height of the vessel, circumferential angle irons should be used for vertical support and placed at 12 ft. intervals.

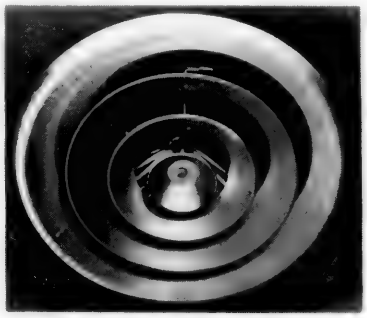
In the case of vertical vessels with conical or convex ends, spot anchors are most desirable. Angle clips with holes punched in one leg or hex nuts are welded to the surface and spaced in a pattern of concentric rings. The anchors in each ring are equally spaced with a 12 in. maximum spacing between rings. The blocks are held in place with wires secured to the anchors and tied across the face of the blocks.

NEWS OF EQUIPMENT AND MATERIALS

Use the convenient prepaid postcard appearing on page 121 for securing additional information on new equipment and materials described in this department.

Center-Induction Ceiling Diffuser

A round ceiling air diffuser unit with a center induction feature and radial distribution is announced by Anemostat Corporation of America, New York, N. Y. The unit is designated the CM-1-100 and is available in four sizes.



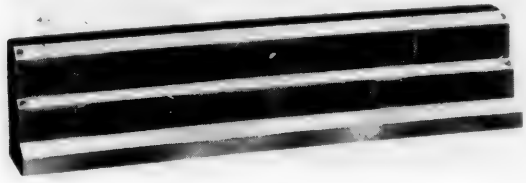
Operating on the principle of 100% aspiration, the unit induces, through the center of the diffuser, approximately 100 cfm of room air for every 100 cfm of primary air brought into the unit. The unit has the advantage of discharging air outward along the ceiling in layers and drawing room air in through the center of the unit, thus creating a uniform air flow throughout the room. Supply air is mixed gradually with air in the room for draftless distribution. The unit can handle temperature differentials which are limited only by the characterstics of a practical refrigeration cycle.

More information? Circle Item 1 on postcard, page 121.

Extended Baseboard Diffusers

A new line of extended baseboard diffusers, Series 72, is being manufactured by Lima Register Co., Lima, Ohio.

Featuring larger capacity, the diffusers are especially suitable for air conditioning installations using baseboard supply outlets. The 2-ft size (see illustration) has 26.6 sq in. of free area and meets most residential



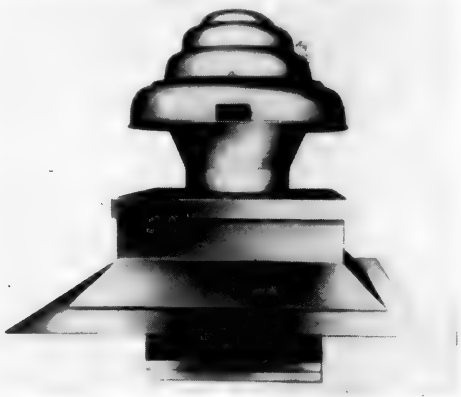
requirements. The 4-ft size has double capacity for commercial installations.

For large areas such as stores, offices, churches, and factories, the diffusers can be connected in any multiples required by using the company's joining connectors. The diffusers have the same automatic pushbutton damper, modern styling, heavy construction, and permanent finish as the company's other extended baseboard diffusers and matched return air grilles.

More information? Circle Item 2 on postcard, page 121.

Device Curbs Roof Fan Noise

Roof fan noises are controlled by a sound-absorbing device announced by Penn Ventilator Co., Philadelphia, Pa. Known as the Sonotrol Curb, it has a high efficiency



acoustical surface mounted directly below the fan, eliminating resonance, echoing, and reverberation of flat, hard surfaces at the source.

Installed easily, the device provides a stable support and housing for motor and gravity-operated dampers, in addition to its noise reduction feature.

More information? Circle Item 3 on postcard, page 121.

Regrinding Swing Check Valve

A regrinding swing check valve has been added to its line of bronze industrial valves by Ohio Brass Co., Mansfield, Ohio.

The Y-type valve is available in ten sizes from ¼ to 3 in. in pressure ratings of 150wsp/300wog and 200-wsp/400wog. Size and pressure are clearly marked and direction of flow arrows show on both sides.

Body is cast from quality bronze alloy meeting requirements of ASTM B62-52 and is of uniform thickness. Other parts are of brass rod or bronze alloy.

Two side plugs, instead of the usual one, make hinge pins readily accessible from either side for easy removal of disc holder when valve is mounted close to wall or other obstruction. Sturdy pipe end lugs provide firm gripping edges for wrench.

Removing valve from line is unnecessary when seat and disc wear on this type valve. Regrinding takes a matter of minutes, depending upon condition of seating surfaces.

More information? Circle Item 4 on postcard, page 121.

Purifier Has High Efficiency

A new device to recover the valuable minerals and liquids vented to the atmosphere by industry is Model LUS Hi-eF Purifier, available from V. D. Anderson Co., Cleveland, Ohio.

The unit separates mist, liquids, solids of any type from any gas or vapor by a series of patented vanes and baffles through the application of principles of centrifugal force. Separation efficiency has been improved through the use of the company's vanes and baffles to the point where the units are guaranteed to remove 99% or better of all liquid and solid particles in vapors and gases under normal operating conditions.

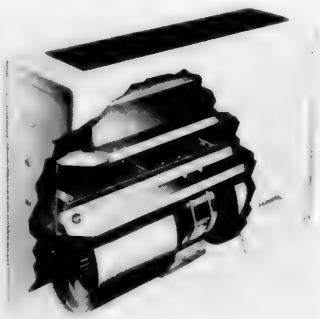
A feature of the purifier is the elimination of screens or filters of any type thereby permitting design of a much smaller unit. The devices are also maintenance-free and no parts require cleaning or replacement. The purifiers are made in a wide range of sizes which are adapted readily to the piping systems of any plant.

More information? Circle Item 5 on postcard, page 121.

Cabinet Unit Heater

The introduction of the Series 45 cabinet unit heater is announced by Fedders-Quigan Corp., Trenton, N. J.

Said to be ideal for installation in lobbies, gymnasiums, auditoriums, offices, churches and other large area hard-



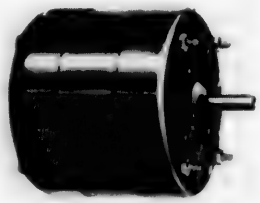
to-heat structures, the Unit heater is adaptable to a wide variety of mountings. It may be installed free-standing, semi-recessed, recessed, or wall or ceiling hung.

Specifications include: resiliently mounted motor and centrifugal blowers; non-ferrous finned tubing, and unit design which permits piping to be concealed underneath or run through ends of cabinet. The Series 45 cabinet unit heaters deliver up to 117,300 Btu per hour.

More information? Circle Item 6 on postcard, page 121.

Small Multi-Speed Motor

Designed and built for use in unit heaters, home air conditioning units, and fans, a 4-pole, shaded pole motor in ratings from 1/25 to 1/10 hp is offered by Fasco Industries, Rochester, N. Y. This motor employs a unique pole configuration which produces better flux distribution, resulting in higher efficiencies and better power factors.



Economies in manufacturing have been accomplished by incorporating a new wound-in-place coil design which eliminates magnetic wedges.

This new motor also incorporates use of improved sintered oil-less bearings in conjunction with large capacity oil-retaining wicks for quiet operation and long life.

Available for single, two, or three-speed operation, the speed torque characteristics of this motor are designed for multi-speed operation.

More information? Circle Item 7 on postcard, page 121.

Shower Valve with Volume Control

A built-in volume control and shutoff is featured by the new Showermaster control unit introduced by Leonard Valve Company, Cranston, R. I.

Incased in a smart chrome panel is a complete, self-contained thermostatic control for individual showers in homes, hotel, motels, schools, hospitals or clubs.

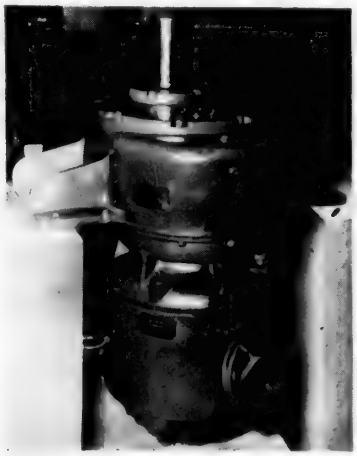
In addition, the bi-metal Dura-trol thermostat automatically compensates for temperature and pressure changes in either the hot or cold water supply. Selection of the desired volume, from "soft rain" to full pressure will not affect the resultant temperatures. Safety stops limit the hot water temperature to 115 deg F maximum.

The device has only one moving part which is self-cleaning. There are no seats or seat packings in the thermostatic housing subject to wear. Easily accessible check and stop valves are provided on both inlets. No special skill or tools are required for servicing.

More information? Circle Item 8 on postcard, page 121.

Vertical Gearmotors for Towers

A line of vertical, shaft-up gearmotors for use in cooling tower fan drives is available from Westinghouse Electric Corp., Pittsburgh, Pa. The units are designed to replace present systems that use a separate right-angle speed reducer driven by a horizontal motor through a floating, flexibly-coupled shaft.



The Type U gearmotors are available in ratings from 15 to 75 hp with motor speeds of 1150 and 1750 rpm. Gear efficiencies of 98% or more are possible by the use of simple single-helical gears. Output speeds from 170 to 780 rpm are available. Floating shafts, couplings, and motor mounting bases are eliminated.

Only one supporting structure is necessary. Gears and bearings are supported in a rugged one-piece cast iron housing. An inspection plate in the cover permits convenient examination of the gears and bearings.

A simple, effective lubrication system is used and positive shaft seals keep the oil in and water out.

More information? Circle Item 9 on postcard, page 121.

Wet Back Steam Generator

A 50-hp Steam-Pakette packaged steam generator with a circular water chamber at the rear head is announced by York-Shipley, Inc., York, Pa. The wet back does three things: (1) it carries off excess heat, permitting operation at a higher boiler rating; (2) it provides a condensate receiver, and (3) it preheats the water that goes to the boiler tubes.

The water-cooled rear head makes it possible to obtain up to 50 hp from a boiler formerly rated at 30 hp. Previously, this size of boiler had to be limited to 30 hp because the normal refractory-filled dry back will not stand the temperatures experienced at the higher firing rate. The firing head on the new 50-hp boiler is fundamentally the same as on the 30-hp dry-back boiler, but a larger forced draft blower and a 3-hp burner motor are employed.

As a condensate tank, the cylindrical chamber added onto the rear head functions in the ordinary manner; that is, it collects the condensate return and provides a reservoir for the make-up water. The condensate and the cold make-up water are fed into the rear head in the same manner as they are fed into the conventional condensate tank. However, no extra floor space is required for the condensate system.

Preheating of the water that goes to the boiler tubes increases the overall heating efficiency since most of the heat supplied to the feedwater comes from waste heat, normally exhausted through the stack. Tempering of the cold return and make-up water in the head also prevents the thermal shock encountered when cold water is injected into the boiler.

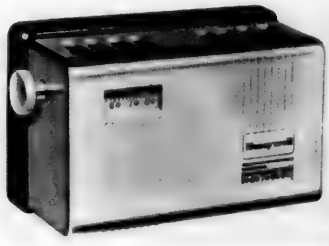
The boiler contains under 100 sq ft of heating surface and slightly less than 3 sq ft of equivalent grate area, thereby permitting operation in New York City and in the Commonwealth of Massachusetts without a licensed operator in attendance.

Boiler may be fired with no. 3, 5 or 6 fuel oil, or by manufactured or natural gas. Steam can be supplied at an operating pressure up to 125 psi.

More information? Circle Item 10 on postcard, page 121.

Electric Heating Thermostats

Two line voltage thermostats have been developed by Minneapolis-Honeywell Regulator Co., Minneapolis, Minn., to take the hot peaks and cold valleys out of electric heating. One does it by fast cycling (up to 20 times per hour), the other by cycling only three to six times an hour.



Designated the T-40, the former is suitable for low-mass, quick heating and cooling units. The latter, called the T-41, is better suited for large-mass, slow heating and cooling systems such as are used in ceiling and floor cable heating applications.

Both instruments operate without supplemental relays or transformers.

The T-40 model (illustrated) is horizontally mounted, is responsive to 0.4 deg F of temperature change, and is designed to cycle up to 15 to 20 times per hour under a normal 50% heating load requirement. It increases comfort in areas where it is used by eliminating wide swings in the temperature of the heating panel surface. This also adds to the life of the electric heating elements.

The vertically-mounted T-41 thermostat uses slow cycling periods to achieve a comfort level when used with large-mass heating elements of the type normally mounted in ceilings, floors, and similar installations. Its operating differential is 1 degree.

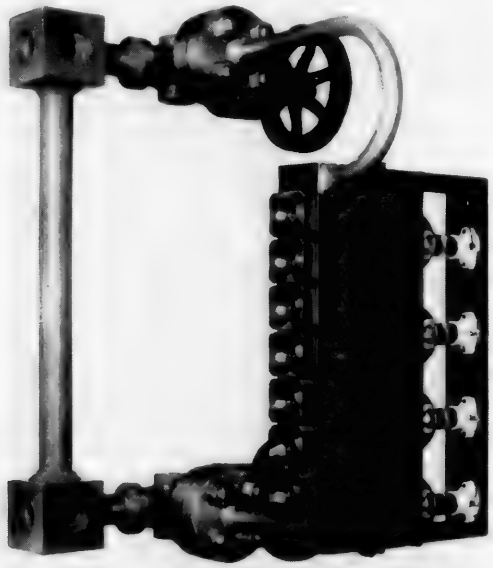
Both models are low priced and feature large vents for sampling air.

More information? Circle Item 11 on postcard, page 121.

Water Gage Shows Red and Green

Water gages for high pressure boilers up to 3300 psi. with two-color red and green readings are announced by Yarnall-Waring Co., Philadelphia, Pa.

In the port-type openings, water shows green, steam



shows red. Thus, a full gage is all green, an empty gage all red. Individual cover-glass assemblies permit convenient servicing of the gage in place, without removal from the boiler.

Large diameter port openings give increased visibility, and a variety of mirror arrangements bring the brightly lighted, head-on view of the gage face to convenient operating-floor locations.

More information? Circle Item 12 on postcard, page 121.

New Line Relieves Hay Fever

The 1957 line of room air conditioners which features equipment to generate negative air ions for the relief of hay fever sufferers is announced by Philco Corp., Philadelphia, Pa. The negative ion generator plus a highly efficient air filter will be known as the Ionitron.

Dr. George Morris Piersol, Dean of the Graduate School of Medicine, University of Pennsylvania, has stated that hay fever sufferers receive relief from their symptoms in a negatively ionized room. This relief is important for the required sleep to build up physical well-being. This, in turn, may also offset recurring symptoms when exposure to outside air and its high pollen count takes place again.

The ion generator section of the four part electrostatic air cleaning system was made possible through an unrelated development of a special voltage regulator tube for color television. Two of these tubes are used to maintain the proper ion level regardless of fluctuations in house current voltage. A third tube is used to change alternating current to the direct current needed for ionization.

After being pre-filtered and negatively charged, the air passes through a second aluminum fine mesh filter. Finally, an activated charcoal filter absorbs odors from the air which is then circulated throughout the room.

More information? Circle Item 13 on postcard, page 121.

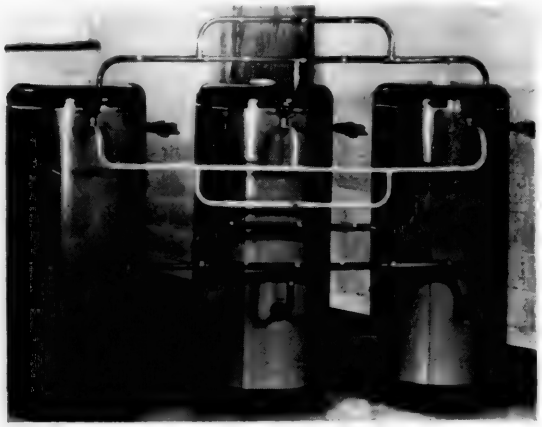
Heater Flows Equalized

To solve the problem of unequal flows of hot water from multiple-unit installations of automatic storage gas water heaters, Ruud Mfg. Co., Kalamazoo, Mich., has developed the Equaflow, a manifold assembly.

The assembly is for use with commercial installations of the company's Sanimaster gas water heaters in motels, hotels, apartment houses, schools, institutions, and restaurants.

To eliminate large storage tanks, increasing numbers of commercial establishments have installed identical commercial gas water heaters in multiple. The problem is to assure perfect balance and an equal supply of hot water from all water heaters in the installation.

The manifolds are available for duplex, triplex (illustrated), and quadruplex installations of models 72-126, 80-80, or 90-168 Sanimaster water heaters.



Pre-formed and cut from type K copper tubing, the manifolds are furnished as a knock-down package, complete with copper fittings and ready for on-the-job assembly. A small label on each component contains a key letter identification as a guide to the assembler.

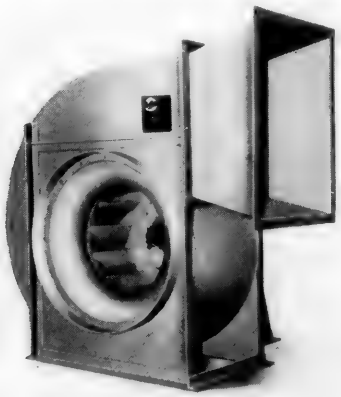
The standard package manifold kit consists of three individual manifolds—cold, mixed, and 180 deg. This makes them ideal for any two-temperature requirement where mixed temperature tap water and sanitizing high temperatures are needed at the same time, such as for dishwashers and laundry machines.

Mixed water is produced by the company's duo-temp valve. If only a single temperature is required, one manifold can be eliminated and plugs can be inserted in the unused outlets.

More information? Circle Item 14 on postcard, page 121.

Fans Have Airfoil-Type Blades

A series of airfoil blade fans, Type BA, has been added to the lines of radial wheel and backward curve



type fans by Buffalo Forge Co., Buffalo, N. Y. The new fan performs at 92% mechanical efficiency, and is suitable for forced draft as well as industrial air moving service.

The airfoil blades, so-called because of their similarity to airfoil section in aircraft wings, are internally strutted. Blades are very broad at the point where air enters the wheel, providing the deepest possible bite of entering air. Channels between blades form smoothly diverging passages for efficient flow and stability.

Performance tests show broad peaks on the mechanical efficiency curve; thus, a fan may be selected for operation at its point of highest efficiency with assurance of stable performance. In addition, the fans are available with three different airfoil wheels for varying pressure and capacity requirements, as well as three semi-airfoil wheels. Complete engineering data on this series of fans are available.

More information? Circle Item 15 on postcard, page 121.

Vibration Mount

The Universal Lev-Elasto Damper is a low cost machinery mount made by the Korfund Co., Inc., New York, N. Y. It speeds installation and relocation of all

types of equipment, stops vibration transmission, and lowers noise levels.

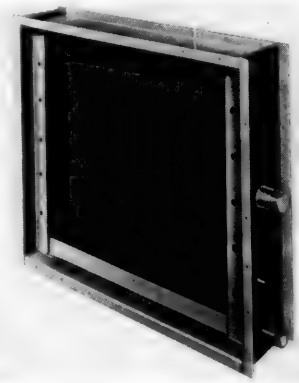
Features include: Internal leveling adjustment permitting installation anywhere under the machine, regardless of position or availability of bolt holes in base, or of base thickness; there are no adjusting bolts protruding from top of the mounting. No bolting of machine to mounting because of the non-skid felt pad on the top plate; however, the mounting can be cemented, or bolted through the tapped hole provided. If desired, it can be cemented to the floor.

Other advantages of the damper: Because of the non-skid tread design machines won't creep; no shimming because twin adjusting bolts simplify leveling; single piece assembly permits mounting and machine to be moved and relocated as a unit. It is available in nine sizes for loads ranging from 65 to 12,000 lb per damper. Prices range from $6 to $35.

More information? Circle Item 16 on postcard, page 121.

Steam Coils Tilt for Drainage

A line of heavy duty, distributor type steam coils with a tilted feature to assure drainage of condensate, whether used for vertical or horizontal air flow, is announced by Rempe Co., Chicago, Ill.



Cover pieces at header and stub ends are perforated to allow passage of measured amounts of by-pass air, resulting in increased coil capacity. Coils are pitched in casing to guarantee full drainage to condensate outlet.

Available with inlet and outlet on same end or on opposite ends, the coils can be supplied with gas tight casing.

These coils have copper tubes of 5/8 inch O.D. by .035 inch wall or stainless steel, with aluminum fins.

Sizes range from 12 to 48 inches face height and from 24 to 120 inches width.

More information? Circle Item 17 on postcard, page 121.

New Blowout Urinal

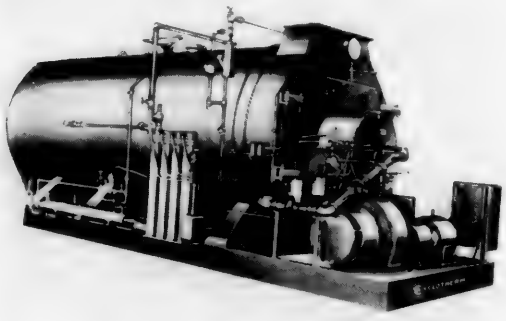
The Challenge vitreous china blowout urinal is offered by Universal-Rundle Corp., New Castle, Pa. The urinal features extended side shields with integral flush spreader and strainer. It has a 1¼ in. top spud for exposed flushometer use or is available with a 1¼ in. concealed back spud for concealed flushometer use. Available in white and six colors.

More information? Circle Item 18 on postcard, page 121.

750 H.P. Package Boiler

A 750 hp package steam generator which can deliver 26,000 lb of steam per hour at over 80% efficiency, has been developed by Cyclotherm Division, National-U.S. Radiator Corporation, Oswego, N. Y.

Overall dimensions are: 28 ft x 9 ft 6 in. x 10 ft 8 in.



Designed for heavy oil or gas, the boiler can be adapted to burn either LP-gas or light oil, as well. Modulation over an extremely wide range permits guarantee of efficiencies of 80% or better down to a small fraction of the rated 750 hp capacity.

The Cyclotherm C-26,000 makes it possible to utilize package boilers for many industrial processing loads formerly considered too big for a single package boiler.

More information? Circle Item 19 on postcard, page 121.

Vertical Drafting Board

A vertical drafting board has been designed to reduce draftsman fatigue by L. A. B. Corp., Skaneateles, N. Y. The vertical feature of the board also prevents dirt and dust collecting on drawings and eliminates smudging.

The board is available in two models, one with a fixed board angle of 15 deg from the vertical and the other adjustable through an arc of 85 deg from the vertical. Both models have an up and down adjustment of 20 in., permitting draftsman to work, seated or standing, on any area of the board without bending or stretching.

Moving members of the board are counterbalanced, and the vertical adjustment is held by a foot-operated lock mechanism. The plastic drawing surface recovers from pencil indentations and compass pointers.

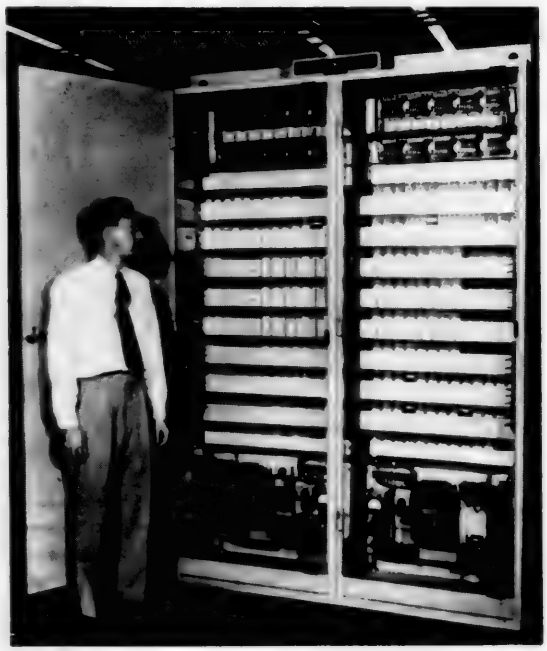
The frame of the drafting board is made of tubular steel with gray iron castings interconnecting the members.

Accessory reference tables may be hinged to the back of the drafting boards, making them suitable for series installation.

More information? Circle Item 20 on postcard, page 121.

Control Parts Encapsulated

Designed to aid in the automation of various low-power switching operations, a static switching control



system that accomplishes the control functions historically performed by contact making devices, such as relays, is announced by General Electric Co., Schenectady, N. Y.

The system makes available a complete line of static components to provide the five logic functions basic to intelligence switching: *and*, *or*, *not*, *memory*, and *time delay*. The logic units and their associated circuit components provide a tool for better performing applications ranging from steel mill processing control systems to the control of individual machines.

The control can be furnished in component form for use of the control designer or in completely engineered panels and systems (illustrated). Design permits it to be combined with available regulating systems of the static type, to make possible a co-ordinated over-all static system.

Employing conservatively rated sub-components, the devices are encapsulated, have no moving parts. Fail-safe circuitry is provided. On return of power after any power removal, they enable the circuit to resume operation at the same point in the cycle where it left off.

The system includes plug-in construction, packaged power supplies, built-in wire trough, and color coding. Trouble shooting can be performed with a standard volt-ohm meter. Monitor lights are also provided for quick checks of proper circuit functioning.

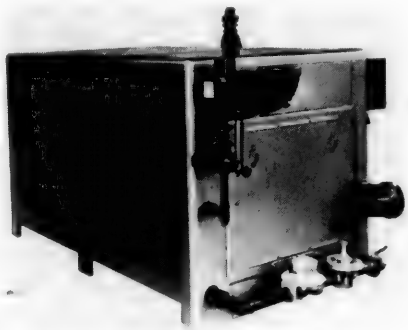
Static switching systems are useful where frequent or continuous operations are needed, or where complex systems or adverse environmental conditions exist.

More information? Circle Item 21 on postcard, page 121.

Boilers Made in 33 Sizes

High capacity Series 150 gas fired, cast iron boilers are available in 33 sizes from Peerless Heater Co., Boyertown, Pa.

Capacity ratings are from 600,000 to 5,400,000 Btu input per hr for steam and hot water supply. Ports and tappings are 6 in. A heavy steel insulated jacket covers the manifold.



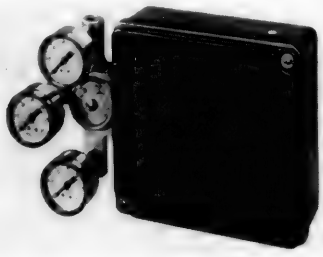
Retained in its new series are the company's water tube sections, end door cleanout, horizontal draft diverters, cast iron five row drilled port burners, heavy cast iron base, and multiple pilot line.

Engineered and built for installations in industrial, commercial, hospital, office, apartment, public, church and military buildings, the end door cleanout makes it adaptable for sewage disposal plants where high condensation is encountered. Where expansion is required, additional multiple sections can be added to increase the boiler's heating capacity.

More information? Circle Item 22 on postcard, page 121.

Precision Pilot Positioner

A fast acting pilot positioner that provides extreme accuracy of control has been developed by the Johnson Service Company, Milwaukee, Wis., for applications requiring precise repositioning even for very small changes in air pressure from the controlling instrument.



Maximum power is available at all times for repositioning the controlled device. Supply air at 15 to 20 psi is connected to the positioner, with a direct acting relay transmitting changes in pilot pressure from the controlling instrument.

Air consumption is exceptionally small. In the case of installations involving large numbers of pilot positioners, this low air consumption will greatly reduce the problem of having to add to compressed air capacity as more pilot positioners are added to the systems.

Fast action is assured through use of the Johnson proportional action, direct acting relay. Other features include adjustable starting points and operating ranges, a bypass switch and indicating gages.

More information? Circle Item 23 on postcard, page 121.

High Efficiency Air Filter

A high efficiency dry type, renewable media air filter, the Multi-Pak, is made available by American Air Filter Co., Inc., Louisville, Ky.

The filter was developed for those applications that require air filters of standard construction but need

higher-than-normal cleaning efficiencies. Its effectiveness can be regulated by use of a variety of media, ranging from inexpensive cellulose fiber sheets, through dense glass fiber mats. The variety of thicknesses, densities, and textures make it possible to obtain any desired efficiency in dust and smoke removal from plant pollen to tobacco smoke, even at extremely high temperatures and with minimum operating costs.

There are more than fifty sq ft of media in the seven pockets of one 24 x 24 x 22¾ inch unit, thirteen times more media surface than face area. Permanent media frames insure a good seal and makes media servicing simple and inexpensive.

More information? Circle Item 24 on postcard, page 121.

Heater Keeps Equipment Dry

To protect electronic equipment from the harmful effects of condensation due to temperature changes, a low wattage electric heater is developed by Dampp-Chaser Inc., Hendersonville, N. C.

The 25 watt unit, 36 in. long, ¾ in. diameter, is designed to continuously maintain the equipment 2 or 3 deg above ambient air temperature. The long, thin heating elements distribute the heat evenly throughout the equipment. It will withstand voltage surges, is tamper proof, and cannot cause fires.

More information? Circle Item 25 on postcard, page 121.

PVC Expansion Joint

The first slip type pipe expansion joint of unplasticized polyvinyl chloride is introduced by Tube Turns Plastics, Inc., Louisville, Ky. It is made in 1, 2 and 3 inch (illustrated) sizes, and may be used with piping of smaller diameters by employing reducing bushings. All sizes allow an expansion of 3¾ inches.

The new expansion joint is designed for use with rigidly fixed PVC piping subjected to thermal cycles. It has a Neoprene O-ring packing and is suitable for a wide range of corrosive services. When made of normal impact PVC, the 1 inch size has a pressure rating of 205 psi at 75 deg, and of 120 psi at 140 deg; the 2 inch size has a pressure rating of 170 psi at 75 deg, and of 100 psi at 140 deg; the 3 inch size has a pressure rating of 150 psi at 75 deg, and of 90 psi at 140 deg.

The joint has been tested at pressures up to 325 psi, and temperatures up to 140 deg.

More information? Circle Item 26 on postcard, page 121.

Piped Chemical Fire System

A compact low-cost automatic dry chemical fire extinguishing system for flammable liquid, electrical and textile fire hazards has been developed by Ansul Chemical Company, Marinette, Wis.

The 30 lb piped system, which can be operated either automatically or manually, is intended primarily for protection of moderately-sized hazards such as paint spray and dip operations, and heat-treating and oil quench operations.

The unit consists of a 30 lb capacity dry chemical unit installed near the hazard and serving as a storage tank for the dry chemical. A special CO_2 gas pressure cartridge furnishes pressure to expel the dry chemical onto the fire through piping connecting the dry chemical unit with the hazard area.

Depending on requirements of the hazard, the system can provide total flooding or local application. Special nozzles are provided to give the most efficient discharge of dry chemical for each type of application.

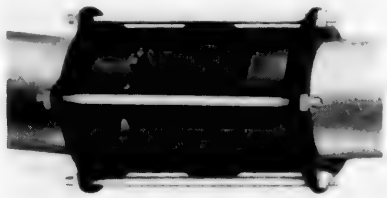
Automatic operation occurs when heat of a fire causes a fusible metal link located above the hazard to part. The impulse is transmitted to the release mechanism located at the dry chemical unit which causes the cartridge to be punctured, pressurizing the extinguisher and forcing its dry chemical charge into the piping leading to the nozzles.

More information? Circle Item 27 on postcard, page 121.

Coupling Repairs Pipelines

A coupling for repairing misalignment breaks in water, gas or oil pipelines has been improved by Smith-Blair, South San Francisco, Calif.

Called the Series 4K, the cut-in coupling is applicable to cast iron, asbestos-cement, or steel pipe and is installed with the pipe in place. It acts as a double coupling replacing twice the length of pipe cut out.



Pipe may be repaired by cutting out any break, broken flange, bell, or pipe coupling and using the cut-in coupling.

A feature of the coupling is a dual sleeve plus a centering ring. When the break in the pipe is cut out sufficiently for one sleeve to be placed, all the parts of the coupling are then assembled to repair and connect the pipe while in place. The coupling consists of two sleeves, two gaskets, two flanges and a centering ring complete with gaskets which are tightened, as an assembly, on the pipe with through bolts.

The pipe can be out of alignment over 6 degrees and be repaired in place. The cast units are made with ductile iron flanges and cast iron sleeves to resist corrosion, so that the flexible coupling will last as long as the pipeline on which it is installed.

Sizes from 2 to 12 in. are now in production. Larger sizes, in steel, are also available.

A new bulletin describing the cut-in coupling is available.

More information? Circle Item 28 on postcard, page 121.

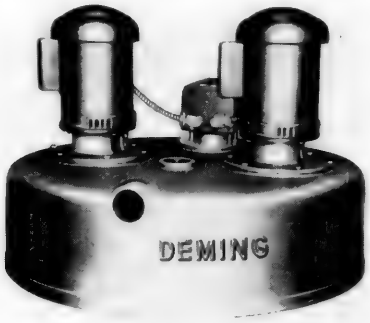
Prints Filed Safely, Neatly

Holes and other mutilations in blue prints are eliminated with friction type binders produced by Plan Hold, South Gate, Calif. A new eight-page catalog, The Plan Hold Story, is available.

More information? Circle Item 29 on postcard, page 121.

Condensation Return Pumps

Single and duplex Hotshot condensation return pumping units have been added to the line of commercial and industrial pumps and water systems manufactured by The Deming Co., Salem, Ohio. The new units are rated



up to 10,000 ft of direct radiation with pressures up to 20 lb. High-pressure units are available up to 50 lb. Shallow-type, cast iron receivers in 6 or 20-gal sizes permit low connection to the return line. No foundation bolts required. Units can be set on floor or in a shallow pit.

The centrifugal pump has a fully enclosed bronze impeller, stainless steel shaft and compression type coupling. Capacitor motor has built-in thermatron and overload protection with automatic reset.

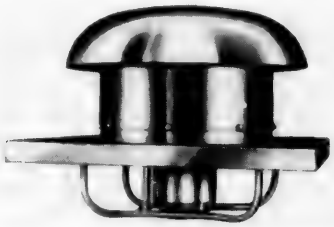
Automatic controls have a double pole switch mounted on the receiver and operated by a float. No diaphragm or stuffing box is used. Duplex units are equipped with alternator float switch which operates pumps in sequence or together under peak loads. They deliver twice the single pump capacity while operating against the same pressure.

More information? Circle Item 30 on postcard, page 121.

Squat Exhauster Is Reversible

Overall height of less than 18 in. of its axial mushroom power exhauster is announced by Chicago Blower Corp., Franklin Park, Ill.

Light-proof and weather tight, the roof ventilator can be used for either air intake or exhaust. Aerodynamically designed guide vanes in the head combined with airfoil-



shaped fan blades offer greater air moving efficiency with less noise and turbulence. The units have a base that is die-formed in one piece and welded at all four corners. A venturi throat in the base cuts down air turbulence before it passes through the fan to the outside atmosphere.

Of aluminum, stainless steel, or heavy gage steel construction, the fans have acid resistant paint applied as needed for special industrial installations. Enclosed, ball bearing type motors, either permanently sealed or with grease lines, furnish the power. The entire head and sleeve lift off for access to the wheel and motor.

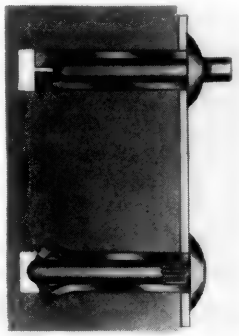
The axial fans are capable of exhausting 350 to 34,430 cfm of fumes, smoke and dust. Fan blade diameters range from 9 to 48 in. The fan and motor are one direct-connected package. It takes four bolts to fasten the unit to wood, steel or concrete. The bases are furnished for curb mounting, flat or pitched.

More information? Circle Item 31 on postcard, page 121.

Masonry Anchor

A one-piece masonry anchor named Pin-Grip, is introduced by Star Expansion, New York, N. Y.

To install the anchor: Drill a hole in masonry (concrete, brick, cement or cinder block) with a masonry bit or a hammer and drill the diameter of the anchor. Insert the anchor through the fixture into the masonry hole. Drive the pin flush with the anchor head using an ordinary hammer. The stainless steel pin, nested in the bored aluminum body of the anchor, forces out four expanding prongs which grip the wall within the masonry hole.



The masonry anchor is recommended for securing pipe anchors and straps, ventilating and air conditioning ducts, and sanitary fixtures to any kind of masonry. A range of sizes is available for different requirements.

More information? Circle Item 32 on postcard, page 121.

Insulation Guarded By Springs

Prevention of damage to insulation of hot tanks, towers, pipes and vessels when they expand and contract is the purpose of breather springs, manufactured by Techalloy Co., Inc., Rahns, Pa. The spring bands follow tank line while gently holding insulation materials in place.

In original recommended length the spring bands are 4 in. long. At fully expanded length they measure 16 in.

Made from .105 in. diameter stainless steel, they have a tensile strength of 275,000 psi, high resistance to chemicals and acids, and excellent spring advantages up to 600°F. Only 3/8 in. thick, they will not protrude through covering materials.

More information? Circle Item 33 on postcard, page 121.

Dual-Valve Steam Trap

A small light-weight bucket type steam trap, the Unitrap, is available from Perfecting Service Co., Charlotte, N. C. The unit which is designed for use on unit

heaters, small processing machinery and like applications is available in ½ to 2-in. pipe sizes, with a pressure range from 0 to 125 psi.

The trap operates on a balanced pressure principle through the function of its Dual-valve, which automatically compensates for differential pressures through a range of 0 to 250 psi. This valve permits the trap to operate through fluctuating steam pressures and variable condensate rates without changing orifice size or bucket weights.

The large orifice achieves high discharge capacities ranging from 3500 lb per hour in the ½ in. size to 55,000 lb per hour in the 1½ and 2 in. traps.

More information? Circle Item 34 on postcard, page 121.

High Temperature Pipe Insulation

A wide temperature range molded insulation, Kaytherm, which is designed for use on steam and heated process piping is being introduced to the market by Keasbey & Mattison Co., Ambler, Pa. The insulation is made by reacting lime and diatomaceous earth under suitable conditions of heat and water to form a hydrous calcium silicate which is bonded together with asbestos

fibers. This low conductivity insulation withstands pipe temperatures up to 1350 degrees Fahrenheit.

Produced in half-cylindrical sections and segments 36 in. long, it is easy to install requiring only simple encircling metal bands to fasten two mating sections to a pipe. It can be cut easily and worked with ordinary tools. This insulation comes in a variety of thicknesses ranging from 1 to 4 in. and will accommodate pipes up to 33 in. in diameter.

The insulation is flame-resistant, chemically inert, and insoluble in water. Its compressive strength permits it to be laid over irregular shapes, bolts and depressions and held tight without concern of breakage.

More information? Circle Item 35 on postcard, page 121.

Jacketed Steel Boiler

A new line of steel boilers is now available from Pacific Steel Boiler Div., National-U. S. Radiator Corp., Johnstown, Pa. The line serves building heating requirements of from medium size residences through small commercial property by hand or automatic firing with any fuel.

The boilers are said to be of a new design. Featured construction of the smaller models having 3-in. tubes is a three-pass design that forces products of combustion to travel three times the length of the boiler before escapement. Larger models, for large residences and small commercial installations, have a two-pass design.

The hand fired boilers have net SBI steam ratings of 750 to 4120 sq. ft. and net SBI water ratings of 1200 to 6600 sq. ft. The automatic firing boilers of both two and three-pass design have net SBI steam ratings of 1100 to 5000 sq. ft., and net SBI water ratings of 297,000 to 1,350,000 btu per hour. All units in the series meet ASME boiler code construction requirements.

More information? Circle Item 36 on postcard, page 121.

Exhauster for Roof or Duct

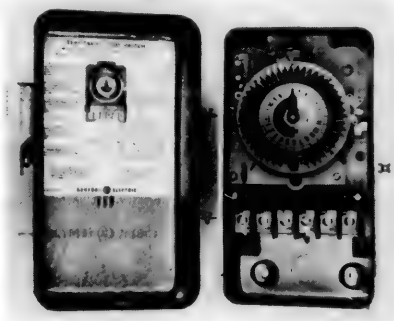
Installation of its all aluminum exhauster on duct or on roof curb for commercial and industrial exhaust is recommended by Airflo Engineering Co., Los Angeles, Calif.

In 6 sizes and 23 capacity ratings, from 150 to 3,000 cfm, it may be direct or belt driven. The blower is of the centrifugal non-overloading type, dynamically balanced.

More information? Circle Item 37 on postcard, page 121.

Time Switch Has Flexibility

A new general purpose time switch, TSA-555, with a multi-tripper dial for extreme flexibility of time setting is announced by General Electric Co., Schenectady, N. Y.



The flexibility of the time switch permits use wherever many varied ON-OFF schedules are required during a 24-hour period. Slots are placed at each ¼-hour point on the dial to permit maximum flexibility of timing schedules. Minimum ON time can be as short as 15 minutes with a minimum ON-OFF cycle of 45 minutes.

When the time switch is used with a contactor or normally open interlock, optional intermittent contaets provide undervoltage protection and automatic sequence restarting in the event of power failure.

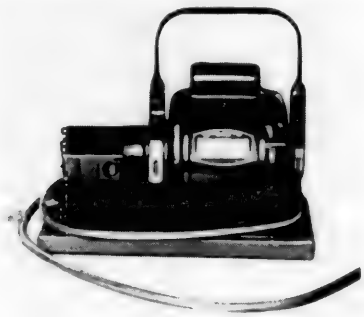
The time switch is supplied as a mechanism alone or with a windowless, weatherproof case, making it suitable for outdoor applications. A descriptive bulletin is available.

More information? Circle Item 38 on postcard, page 121.

Pump Set Is Portable

A portable motor pump set with a capacity of 250 gph is being produced by Webster Electric Co., Racine, Wis.

One primary use of the unit, which weighs 25 lb, is to transfer fuel oil, or any other lubricant, from one



tank to another. The most common use is emptying fuel tanks for cleaning.

Among its other functions for industry as well as for fuel oil dealers and servicemen are such applications as changing oil in a hydraulic system, as a temporary set-up when a hydraulic system goes out of operation, or to pump out water.

The set consists of a 3LBM pump, a ¼-hp Leland motor, and a 25-ft extension cord on a self-winding reel. The external gear pump is available with an internal relief valve permitting regulation of pressures between 50 and 200 psi. An end face seal and helical gears are standard on all pumps. The pumps are made for handling Nos. 1, 2, or 4 fuel oil.

Smaller capacities are also available for the service units.

More information? Circle Item 39 on postcard, page 121.

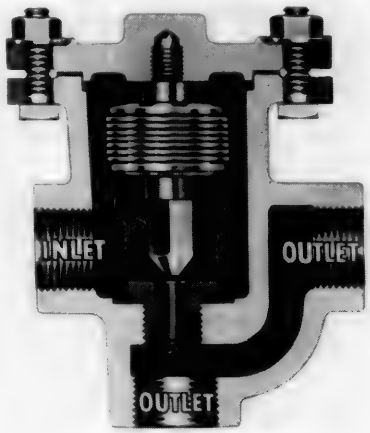
Gas-Fired Warm Air Furnaces

Three new gas-fired warm air furnice models are announced by Delta Heating Corp., Trenton, N. J. Ratings range from 80,000 to 120,000 Btu per hr, and manufacturer's inshot type burner handles natural, manufactured, mixed, or L-P gases. The units are fully enclosed, completely wired, and measure 4½ ft from top to bottom.

More information? Circle Item 40 on postcard, page 121.

Bellows Thermostatic Traps

A new series thermostatic steam trap is a new product of the Clark Manufacturing Co., Cleveland, Ohio. Of cast semi-steel, cast steel or cast bronze construction, the traps are designed for installations requiring: a wide



variation between startup and operating load, frequent shutdowns and startups, or large amounts of air elimination on startup or during operation. Freeze-up danger has been decreased by providing traps with bottom outlet.

Made in three series, each trap is fitted with an orifice that operates the entire pressure range, from 0 gage to maximum rated pressure, without necessity of adjustment. Traps are available for steam pressures up to 300 psi and temperatures up to 500 deg F. Inlet and outlet connections range from ½ to 2 inches. Optional piping, angle or straight-through, is available on the cast semi-steel traps. Traps are freeze-proof when vertical outlets are used. Each trap is provided with bronze or monel bellows.

More information? Circle Item 41 on postcard, page 121.

PRODUCT APPLICATIONS

New, Unusual, or Ingenious Uses of Equipment and Materials

No Room for Air-Cooled Condenser, It Perches on Outside Wall

PROBLEM: The A. R. Spartana Co., Baltimore, television and radio parts distributing firm, desired to modernize with the addition of air conditioning and found that store space, while limited, would accommodate the installation of a combination cooling-coil and fan unit. However, finding a suitable spot for the location of a 5-hp Airtemp waterless condenser represented a temporary poser. The

condensing unit could not be installed directly in the store or in the store basement because an adequate air supply could not be obtained. Neither could the building roof, a popular equipment site, be used. Nor was there outside space at the rear of the store sizable enough to accommodate the equipment.

SOLUTION: With apparently no room anywhere, it appeared that for the store to have air conditioning, the condenser would have to be installed in the air. Surprisingly enough, this is where it was finally placed.

RESULTS: As shown, the conditioner, connected via refrigerant lines with the store's coil and fan unit, is perched in the air on a special, elevated steel pedestal on the outside of the wall.

Watering System for Mink Improves Pelt Quality

PROBLEM: It seems that mink are discriminating about the water they drink—so choosy, in fact, that unless the water is fresh, they just won't touch it. This has meant that each individual mink cage had to be watered individually, quite a task if there are several hundred of the little animals to be cared for, as there are on the Rice Acres Mink Ranch near Chesterton, Ind.

SOLUTION: Owner W. S. Rice and Crane Co. salesman Lee Kodat, using Crane valves and plastic pipe, designed an automatic watering system that provides mink with fresh water 24 hours a day and frees men for other work around the mink ranch. Plastic pipe is run down the side of each mink shed, with petcocks positioned to supply individual watering dishes. An electronic timer and solenoid valve are hooked up to release water into the system. Once every two hours, the timer operates the solenoid valve, so that fresh water flows into each cup for a period of 1½ minutes. The first installation of the automatic watering system was made on a shed containing 114 mink cages. It used 500 feet of ¾-inch Crane plastic pipe.

RESULTS: The system works a full 24 hours and the mink get fresh water as often as they need it, night or day. The old system of hand-watering made it available to them only during daylight hours. Similar systems are now being installed on other sheds at Rice Acres, which now counts a total mink population of 168 males, 680 females, and 2720 kits. The owner is happy with the watering system and claims that the mink drink more, eat more and grow better pelts.

Toolmaking Water Demands Are Reduced

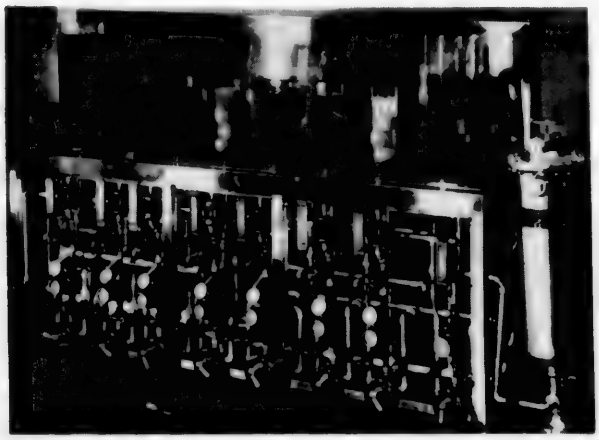
PROBLEM: Manufacturing cemented carbide tools requires sintering in hydrogen or vacuum furnaces at 2700 deg F. For these furnaces and for a variety of other applications, such as the cooling of high frequency induction coils, vacuum pumps, the after cooler on an air compressor, an X-ray machine transformer, and a high frequency converter, the Firth-Loach Metals Co., Pittsburgh, Pa., required a large amount of cooling water.

SOLUTION: Charles H. Miller, maintenance superintendent of the company, working with Horace I. Schmidt of Halstead & Mitchell, devised a system involving a central sump into which cooling water from all operations is passed. From this sump the water is pumped (by the pump at the left) to a cooling tower and then circulated into the other half of the sump from where it is distributed (by the pump at the right) back into the operations.

RESULTS: The company's water bill is now 10% of what it was prior to the installation of the cooling tower. Since output is up 50%, the cost is really one fifteenth of what it would have been without the cooling tower.

Water Mixing Control Solves Test Problem

PROBLEM: A major chemical processor, National Aluminate Corp., Chicago, lists among its many products 58 different formulae made in soluble briquette or ball form for boiler water treatment and for control of microorganisms in water systems and paper processing operations. Solubility standards for each of the formulae must be rigidly maintained to assure the customer of accurate treatment control. If solubility is too high, the user will be wasting money. If solubility is too low, the user will not get the results expected. Varying water temperatures, the processor found, were hampering its quality control procedures.



SOLUTION: To maintain solubility standards, the company tests each formula production run by subjecting a sample to a solubility test. In testing, the briquettes are placed in water flowing at the rate of 1 gpm for four hours. They are then weighed to determine solubility loss which may range from 30 to 90%, depending on the formula. To facilitate this testing, a test rack was developed which uses a Powers type thermostatic water mixer. Essentially, the rack consists of eight individual glass water chambers in which the briquettes are placed. Each chamber has its own water line, drain, flow meter, thermostatic mixer, and thermometer.

RESULTS: The Powers mixers permit control of the water temperature to within plus or minus 2 deg of the standard 60 deg setting, and this control is maintained regardless of temperature and pressure changes in the hot and cold water supply lines. Maintenance costs are reported by A. E. Dupree, chief production chemist, to be extremely low.

Scale Solvent Saves New Concrete Floor

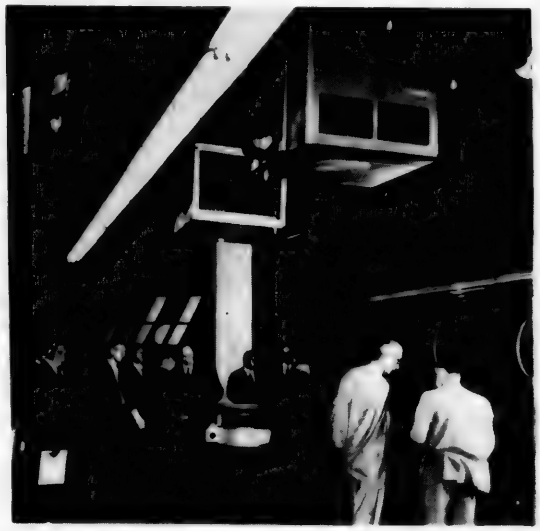
PROBLEM: John J. Calnan Co., plumbing contractors, put in the plumbing and drainage work at the Hurley school in Chicago, Ill. After they had finished their work, a concrete floor was laid in the basement. Somebody, in order to dispose of some excess water, pulled the drain plug and allowed the excess water and concrete to go into the drian. A complete stoppage of the drain resulted and the plumbing contractors were held responsible.

SOLUTION: The plumbing firm ordered four gallons of a scale and rust solvent called Calci-Solve (Nyco Products Co.) that will also dissolve concrete without damaging piping metals. One half gallon was all that was needed to open the drain.

RESULTS: The solvent had saved the time, labor, and expense of breaking through the concrete floor and laying a new drain.

Conditioning Permits Use of Tunnel for Display

PROBLEM: A cool, pleasant enclosure in a tunnel where the temperature is consistently over 90 deg was required. The tunnel, part of the complex maze of underground passages that make up Grand Central Terminal, is being used to display Pioneer III, an ultra-lightweight railway passenger coach of Budd Company. The Budd planners, seeking a central location for the convenience of railroad officials and the press, found the Grand Central tunnel, under the Waldorf-Astoria Hotel, ideally situated but unsatisfactory in that it was dirty and the already hot enclosure would be made even hotter by the lights necessary to illuminate the area.



SOLUTION: The problem was passed to the Structural Display Corporation, engaged to build the enclosure, which promptly passed it on to the Billen Engineering Company, a New York distributor for Typhoon Air Conditioning Company. After studying the difficulties involved in the task, the Billen engineers worked out an arrangement of Typhoon waterless air conditioning equipment. The problem was complicated due to the fact that the partitions of the enclosure left a four foot opening around the top. From ceiling to floor in the tunnel is sixteen feet; the partition is twelve high. Fifteen tons of Typhoon air conditioning equipment—three 5-ton air cooled condensing units and three 5-ton low side air handling units—were used.

RESULTS: The air conditioning provided a 70 to 75 deg. temperature in the tunnel, a 15 deg. drop, even when 100 persons were occupying the 140 x 30 ft. enclosure.

DEGREE-DAYS FOR SEPTEMBER, 1956

(A) Airport readings; (C) City office readings; (O) Readings at a point on outskirts of city

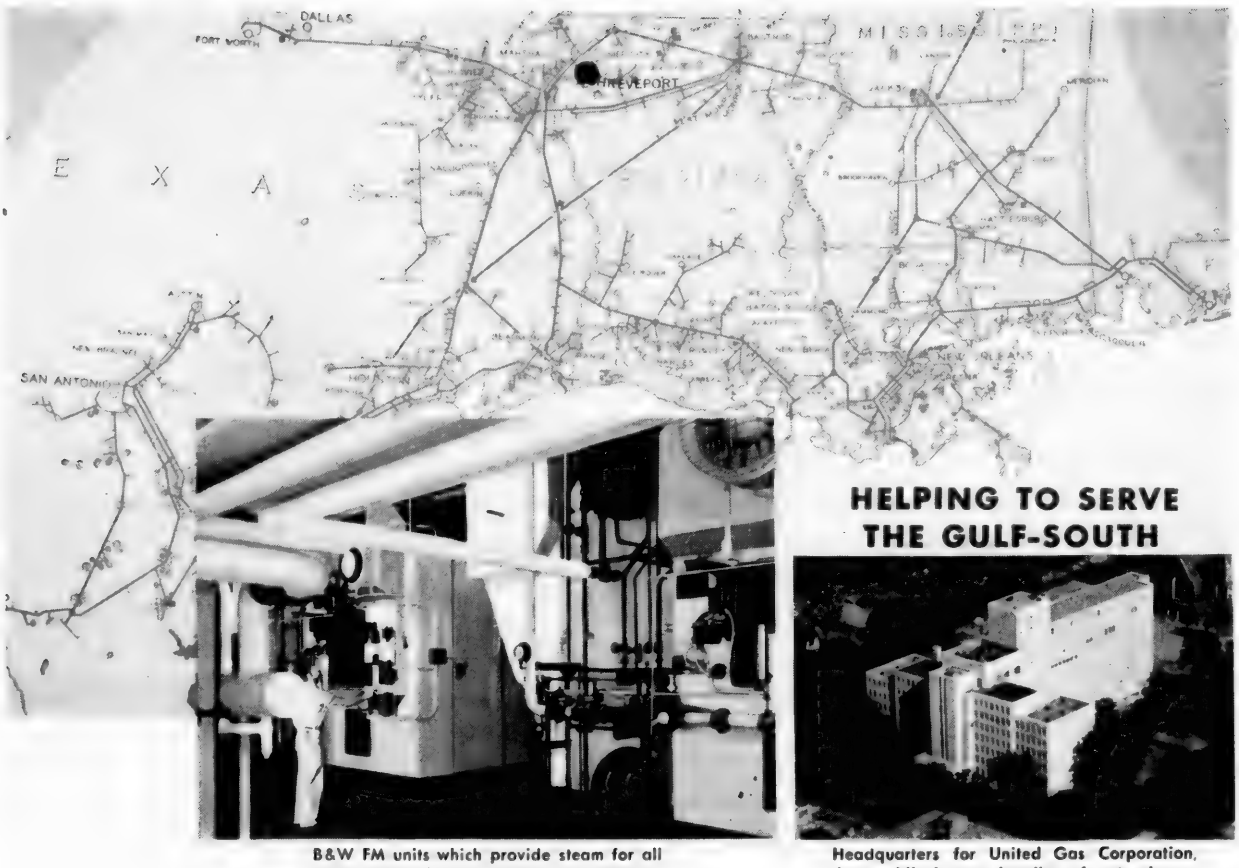
AIR CONDITIONING, HEATING AND VENTILATING'S 29th Year of Publication of Monthly Degree-Day Data

City	September			Season to September 30, incl.*		
	1956	1955	Normal	1956	1955	Normal
Abilene, Texas (A)	0	0	5	0	0	5
Albany, New York (A)	262	174	139	262	174	139
Albuquerque, New Mexico (A)	0	1	10	0	1	10
Alpena, Michigan (C)	354	217	215	354	217	215
Anaconda, Montana (C)	224	363	335	224	363	335
Asheville, North Carolina (C)	82	11	50	82	11	50
Atlanta, Georgia (A)	5	0	8	5	0	8
Atlantic City, New Jersey (C)	70	25	29	70	25	29
Augusta, Georgia (A)	18	0	0	18	0	0
Baltimore, Maryland (C)	60	24	29	60	24	29
Billings, Montana (A)	140	239	194	140	239	194
Binghamton, New York (C)	223	148	141	223	148	141
Birmingham, Alabama (A)	2	0	13	2	0	13
Bismarck, North Dakota (A)	287	252	227	287	252	227
Block Island, Rhode Island (A)	125	74	88	125	74	88
Boise, Idaho (A)	95	192	135	95	192	135
Boston, Massachusetts (A)	174	85	77	174	85	77
Bozeman, Montana (C)	195	338	336	195	338	336
Buffalo, New York (A)	218	137	122	218	137	122
Burlington, Iowa (A)	83	56	83	83	56	83
Burlington, Vermont (A)	298	229	172	298	229	172
Butte, Montana (C)	260	360	344	260	360	344
Cairo, Illinois (C)	5	0	28	5	0	28
Charleston, South Carolina (C)	3	0	0	3	0	0
Charlotte, North Carolina (A)	46	1	7	46	1	7
Chattanooga, Tennessee (A)	15	0	24	15	0	24
Cheyenne, Wyoming (A)	136	221	241	136	221	241
Chicago, Illinois (C)	72	34	76	72	34	76
Cincinnati, Ohio (C)	50	7	42	50	7	42
Cleveland, Ohio (A)	159	52	75	159	52	75
Columbia, Missouri (A)	31	31	62	31	31	62
Columbia, South Carolina (A)	23	0	0	23	0	0
Columbus, Ohio (C)	94	27	59	94	27	59
Concord, New Hampshire (A)	323	210	192	323	210	192
Concordia, Kansas (C)	41	56	55	41	56	55
Dallas, Texas (A)	0	0	0	0	0	0
Dayton, Ohio (A)	106	29	74	106	29	74
Deer Lodge, Montana (C)	330	394	399	330	394	399
Denver, Colorado (A)	68	126	120	68	126	120
Des Moines, Iowa (A)	103	70	99	103	70	99
Detroit, Michigan (A)	172	80	96	172	80	96
Devils Lake, North Dakota (C)	373	325	276	373	325	276
Dodge City, Kansas (A)	16	63	40	16	63	40
Dubuque, Iowa (A)	173	104	149	173	104	149
Duluth, Minnesota (C)	415	281	277	415	281	277
Elkins, West Virginia (A)	189	71	122	189	71	122
El Paso, Texas (A)	0	0	0	0	0	0
Ely, Nevada (A)	159	263	228	159	263	228
Escanaba, Michigan (C)	345	220	247	345	220	247
Evansville, Indiana (A)	55	8	59	55	8	59
Fargo, North Dakota (A)	291	231	215	291	231	215
Fort Smith, Arkansas (A)	0	0	9	0	0	9
Fort Wayne, Indiana (A)	141	64	107	141	64	107
Fort Worth, Texas (A)	0	0	0	0	0	0
Fresno, California (A)	0	1	0	0	1	0
Galveston, Texas (C)	0	0	0	0	0	0
Grand Junction, Colorado (A)	8	33	36	8	33	36
Grand Rapids, Michigan (A)	197	142	144	197	142	144
Green Bay, Wisconsin (A)	300	199	183	300	199	183
Greensboro, North Carolina (A)	75	12	29	75	12	29
Greenville, South Carolina (A)	43	1	10	43	1	10
Harrisburg, Pennsylvania (A)	146	67	69	146	67	69
Hartford, Connecticut (A)	267	120	101	267	120	101
Hatteras, North Carolina (C)	2	0	0	2	0	0
Havre, Montana (C)	210	327	270	210	327	270
Helena, Montana (A)	116	330	320	116	330	320
Houston, Texas (C)	0	0	0	0	0	0
Huron, South Dakota (A)	186	169	149	186	169	149
Indianapolis, Indiana (A)	104	29	79	104	29	79
Jackson, Mississippi (A)	0	0	0	0	0	0
Kansas City, Missouri (A)	17	18	44	17	18	44
Knoxville, Tennessee (A)	31	0	33	31	0	33
La Crosse, Wisconsin (A)	187	118	152	187	118	152
Lander, Wyoming (A)	131	229	244	131	229	244

(a) Data not available.
*Heating season cumulative, from Sept. 1.
**Same normal figures as previously listed by HEATING AND VENTILATING since new figures are not available. All other normal figures in this table are based on a 30-year period covering 1921 to 1950, inclusive, recently compiled and published by the U. S. Weather Bureau.

Figures in this table, with eight exceptions, based on local weather bureau reports. Exceptions are Utica and Lewiston, figures for which are furnished through the courtesy of Coke Sales Department, Central New York Power Corp., Utica, N. Y., and Norman E. Ross, Bursar, Bates College, Lewiston, Me., respectively; Anaconda, Bozeman, Butte, Deer Lodge and Livingston, Mont., through the courtesy of the Montana Power Company. Tacoma figures through the courtesy of the Tacoma News Tribune.

[Table concluded on page 142]



B&W FM units which provide steam for all requirements in the United Gas Building.

HELPING TO SERVE THE GULF-SOUTH

Headquarters for United Gas Corporation, the world's largest handler of natural gas.

B&W FM Boilers Provide Steam for AIR CONDITIONING • HEATING

United Gas Building

United Gas Corporation and its subsidiaries of Shreveport, Louisiana, one of the largest systems of its kind in the world, supplies natural gas to a large and growing part of the southern section of the United States —the "Gulf South". And when the installation of modern heating and air conditioning facilities in the company's Shreveport headquarters building was being studied, the same careful consideration applying to other phases of the company's far flung operations was given to the selection of boilers. As other users have done, United Gas chose two B&W FM Units for a reliable and economical steam source.

In the newly enlarged United Gas Building, the FMs supply the heating load during the winter and steam for the much heavier summertime air-conditioning load. They are gas-fired and designed for manual or semi-automatic operation. Each boiler is designed to generate up to 11,000 lb of steam per hr at an operating pressure of 160 psi. Since their installation in August 1953, the FM Units have provided completely satisfactory service, efficiently and economically.

B&W FM Boilers are available in standard sizes to 40,000 lb of steam per hr at pressures to 235 psi. Many are also in service at higher pressures and with moderate superheat. Write for Bulletin G-76 for complete details. The Babcock & Wilcox Company, Boiler Division, 161 East 42nd Street, New York 17, N. Y.

G-744

FMs Offer These COST-SAVING FEATURES

- Save Erection Time and Cost
- Meet Wide Range of Service
- Handle Quick Load Changes
- Suitable for Outdoor Service
- Safe, Automatic Operation
- Fast Steaming
- Low Maintenance
- Easy Accessibility
- Burn Oil and/or Gas
- Save Fuel
- Save Space

BABCOCK & WILCOX

BOILER DIVISION

Degree-Days for September, 1956 (Concluded)

(A) Airport readings; (C) City office readings; (O) Readings at a point on outskirts of city

AIR CONDITIONING, HEATING AND VENTILATING's 29th Year of Publication of Monthly Degree-Day Data

City	September			Season to September 30, incl.*		
	1956	1955	Normal	1956	1955	Normal
Lewiston, Maine (O)	292	199	165	292	199	165
Lincoln, Nebraska (C)	53	63	79	53	63	79
Little Rock, Arkansas (A)	0	0	10	0	0	10
Livingston, Montana (C)	171	304	227	171	304	227
Los Angeles, California (C)	0	6	17	0	6	17
Louisville, Kentucky (A)	63	4	51	63	4	51
Lynchburg, Virginia (A)	92	21	49	92	21	49
Macon, Georgia (A)	5	1	0	5	1	0
Madison, Wisconsin (C)	133	109	137	133	109	137
Marquette, Michigan (C)	362	260	236	362	260	236
Memphis, Tennessee (A)	0	0	17	0	0	17
Meridian, Mississippi (A)	0	0	0	0	0	0
Milwaukee, Wisconsin (A)	188	104	134	188	104	134
Minneapolis, Minnesota (A)	202	136	157	202	136	157
Modine, Illinois (A)	109	71	96	109	71	96
Montgomery, Alabama (A)	0	0	0	0	0	0
Nashville, Tennessee (A)	10	0	22	10	0	22
New Haven, Connecticut (A)	165	98	93	165	98	93
New Orleans, Louisiana (C)	0	0	0	0	0	0
New York, New York (C)	102	30	39	102	30	39
Newark, New Jersey (A)	117	45	47	117	45	47
Norfolk, Virginia (A)	21	0	9	21	0	9
North Platte, Nebraska (A)	120	152	120	120	152	120
Oak Ridge, Tennessee (C)	20	0	0	20	0	0
Oakland, California (A)	36	116	76	36	116	76
Oklahoma City, Oklahoma (A)	0	5	12	0	5	12
Omaha, Nebraska (A)	78	65	88	78	65	88
Parkersburg, West Virginia (C)	110	12	56	110	12	56
Peoria, Illinois (A)	74	41	86	74	41	86
Philadelphia, Pennsylvania (C)	73	16	33	73	16	33
Phoenix, Arizona (A)	0	0	0	0	0	0
Pittsburgh, Pennsylvania (C)	127	30	56	127	30	56
Pittsfield, Massachusetts (A)	327	242	213	327	242	213
Pocatello, Idaho (A)	138	220	183	138	220	183
Portland, Maine (A)	307	246	199	307	246	199
Portland, Oregon (C)	64	106	85	64	106	85
Providence, Rhode Island (A)	194	116	107	194	116	107
Pueblo, Colorado (A)	19	80	74	19	80	74
Raleigh, North Carolina (A)	58	5	10	58	5	10
Rapid City, South Dakota (A)	119	184	193	119	184	193
Reading, Pennsylvania (C)	127	56	57	127	56	57
Red Bluff, California (A)	0	3	0	0	3	0
Reno, Nevada (A)	116	199	165	116	199	165
Richmond, Virginia (A)	75	9	33	75	9	33
Rochester, New York (A)	239	168	133	239	168	133
Roswell, New Mexico (A)	0	0	8	0	0	8
Sacramento, California (C)	0	7	17	0	7	17
St. Joseph, Missouri (A)	36	34	49	36	34	49
St. Louis, Missouri (C)	17	3	38	17	3	38
Salt Lake City, Utah (A)	38	120	88	38	120	88
San Antonio, Texas (A)	0	0	0	0	0	0
San Diego, California (A)	0	1	24	0	1	24
Sandusky, Ohio (C)	136	36	66	136	36	66
San Francisco, California (C)	58	181	110	58	181	110
Sault Ste. Marie, Michigan (A)	423	334	298	423	334	298
Savannah, Georgia (A)	8	0	0	8	0	0
Scranton, Pennsylvania (A)	241	133	115	241	133	115
Seattle, Washington (C)	147	171	134	147	171	134
Sheridan, Wyoming (A)	159	244	239	159	244	239
Shreveport, Louisiana (A)	0	0	0	0	0	0
Sioux City, Iowa (A)	114	97	128	114	97	128
Spokane, Washington (A)	149	238	205	149	238	205
Springfield, Illinois (A)	65	35	56	65	35	56
Springfield, Missouri (A)	23	4	61	23	4	61
Syracuse, New York (A)	225	147	117	225	147	117
Tacoma, Washington (C)	(a)	184	177	(a)	184	177
Toledo, Ohio (A)	190	92	102	190	92	102
Topeka, Kansas (C)	25	28	42	25	28	42
Trenton, New Jersey (C)	123	52	55	123	52	55
Tulsa, Oklahoma (A)	0	0	18	0	0	18
Utica, New York (O)	236	143	182	236	143	182
Valentine, Nebraska (A)	138	156	145	138	156	145
Walla Walla, Washington (C)	52	126	93	52	126	93
Washington, D. C. (C)	79	13	32	79	13	32
Wichita, Kansas (A)	12	17	32	12	17	32
Williston, North Dakota (C)	264	279	261	264	279	261
Winnemucca, Nevada (A)	150	244	180	150	244	180
Yakima, Washington (A)	131	201	150	131	201	150

For footnotes, see page 140.

THE MARK OF QUALITY

BARBER COLMAN

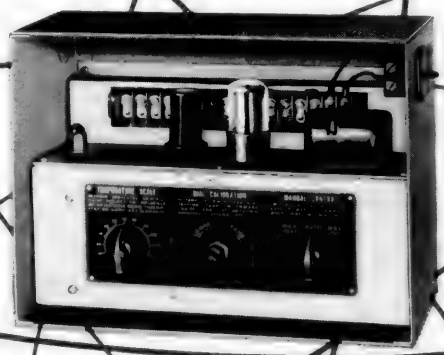
ELECTRIC-ELECTRONIC

Why electronic control?

You get "*flexibility unlimited*" for stabilized temperature control

The only *simple* means of compensated control
Various types of compensating elements are available to anticipate load changes and stabilize discharge temperature. Keeps positive-acting electric controls from hunting or lagging.

Sensing elements located anywhere
Sensing elements are simple coils of temperature-sensitive wire. Dustproof, tamperproof, foolproof, they are equally effective at any distance from electronic panel.

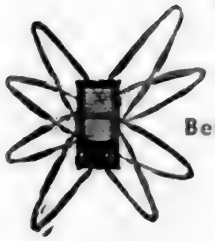


BARBER-COLMAN *ELECTRONIC* CONTROL PANEL

Temperature adjusted remotely
Convenient "Control Center" in equipment room or other central location gives building engineers easy, exclusive control of temperature and thermostat sensitivity settings.

Fewer limitations on automatic sequencing
Electronics makes possible a wider variety of equipment sequencing, providing an unlimited range for the system designer.

No other controls offer such fast, positive response. All settings are made on legibly marked dials. "Control Center" installation streamlines operation . . . eliminates tampering. Components are easily replaceable, and there is practically no maintenance. Learn the details of this truly modern approach to temperature control which Barber-Colman pioneered. Phone our nearby Field Office or write today!



Better control . . . *electronically*

Barber-Colman Company

DEPT. K, 1302 ROCK STREET, ROCKFORD, ILLINOIS, U. S. A.

NEWS OF THE MONTH

COURSE IN AIR POLLUTION

announced for Nov. 26-Dec. 7 by NYU's Post-Graduate Medical School with the College of Engineering.

A course in Air Pollution for the period of November 26 to December 7 has been announced by the Institute of Industrial Medicine, New York University Post-Graduate Medical School with NYU's College of Engineering. The fee will be $75. Applications should be sent to the office of the Dean, Post-Graduate Medical School, 550 First Ave., New York 16, N. Y., not later than Nov. 23.

• **TOPICS**—Subjects to be covered include environmental and economic factors; toxic emissions, case reports; micrometeorology; applications of meteorology; sampling; ecology of air pollution; air cleaning equipment; odor control; incineration; internal combustion engines; power plants; pollution control in specific industries; effects of air pollutants on vegetation; governmental regulations; panel discussion; and a field trip to Brookhaven National Laboratory.

• **SPEAKERS**—Lecturers will be John L. Donovan, Instructor, Post-Graduate Medical School; Dr. Leonard Greenberg, Commissioner, Department of Air Pollution Control, New York City; W. B. Harris, Health and Safety Laboratory, New York Operations Office, Atomic Energy Commission; William T. Ingram, Adjunct Professor, College of Engineering, N.Y.U.; John M. Kane, Manager, Dust Control Division, American Air Filter Company, Inc.; Frederick S. Mallette, Executive Secretary, Committee on Air Pollution Controls, ASME; Dr. Norton Nelson, Chairman, Institute of Industrial Medicine, Post-Graduate Medical School; Arthur C. Stern, Chief, Air Pollution Control Program, Public Health Service, Department of Health, Education and Welfare, Cincinnati; Dr. Gordon H. Strom, Professor of Aeronautical Engineering, College of Engineering, NYU; Dr. Irving R. Tabershaw, Director, Division of Industrial Hygiene, New York State Department of Labor; Walter Tamlyn, R. R. Popham, Consulting Mechanical Engineer; Dr. Amos Turk, Consulting Chemist; Dr. T. W. Zimmerman, Plant Physiologist, Boyce Thompson Institute for Plant Research.

ANTHRACITE HEATING

reported as rising with radiator heat systems setting the pace, accounting for 76.8% of the total.

Statistics issued by the anthracite industry on sales of automatic anthracite equipment for house heating in the first six months of 1956 show two significant trends: (1) All types of anthracite automatic units are selling at substantially increased rates over 1955; (2) Sales are preponderantly of boiler burner equipment.

An analysis of sales, including both new installations and conversions, indicates that 76.8% of all automatic anthracite equipment sales were for radiator heating systems during the period.

The percentage breakdown showed boiler-burner units, 69.7%, furnace-burner units, 16.2%, and automatic conversion burners, 14.1%.

The estimate that 76.8% of all sales was for radiator heating system is based on the conservative assumption that half of conversion burner sales were for boiler heating plants.

June marked the 24th consecutive month in which the sale of automatic anthracite heating equipment surpassed the corresponding month of the previous year.

The present rate of automatic anthracite heating equipment sales for home heating is more than double that of the sales rate for 1953.

MASTER PLAN FOR LARGE BUILDINGS

proposed to provide for future air conditioning to prevent hodge-podge arrangements of equipment

Adoption of a master plan for air conditioning big buildings was predicted by W. G. Wassmandorf, The Trane Company, in a recent talk before a conference of the National Association of Building Owners and Managers. The concept would cover not only that part of the building to be immediately air conditioned by future air conditioning requirements for the entire structure.

• **ABUSES IN PAST**— In the past, the speaker said, owners and tenants undertook their own individual air conditioning installations in existing buildings with a resulting hodge-podge of systems in one building, an overloading of water mains and sewers, abuse of electrical systems, and water restriction complications until finally any air conditioning revisions or additions were doubly expensive. In addition, it was not unusual for an architect to design a building and then turn it over to an engineer with instructions to fit in the air conditioning.

To avoid these past abuses, the speaker pointed to the formula which places increasing emphasis on the need for a master plan for air conditioning existing buildings. The plan should be prepared even if the air conditioning program is not going to begin for two or three years or longer. When planning air conditioning for a large existing building it sometimes is impractical to finance the installaton as a single project. If the owner has his engineering consultants prepare a master plan covering not only that portion to be immediately air conditioned, but also the entire building, he can program his installation. Ultimately he will possess a system as well engineered for satisfaction and economy as if it had been undertaken at one time.

• **INCREASING LIAISON**—Mr. Wassmandorf believes that in the future the consulting engineer will be called on more and more to work with the architect to plan the building design and floor layout to make best use of air

(*Continued on page* 146)

Inside and Outside . . . entirely **new**

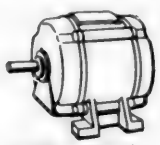
NEW Elliott C-W type N Motor PERMANENTLY SEALED Against Dust, Moisture, Corrosive Fumes

The rugged "Sealedpower" cast frame Elliott motor shown above is the modern version of the design pioneered in this country by Crocker-Wheeler. An external fan, made of sparkless material, and surrounded by a cowl, blows air along the frame for highest cooling efficiency. An internal fan provides continuous air circulation within the enclosure. All openings in the frame are tightly sealed, providing complete protection to windings and working parts.

Once applied only in locations where extremely destructive atmospheric conditions prevail, totally-enclosed motors are today rapidly gaining acceptance for all types of applications. Users find that the total over-all cost—first cost plus maintenance—is less than that of open or semi-enclosed motors.

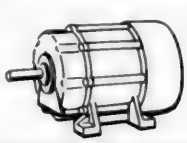
Ask your Elliott representative for details, or write for the new type N motor bulletin. Address Elliott Company, Crocker-Wheeler Division, Jeannette, Pennsylvania.

OTHER C-W TYPE N MOTOR ENCLOSURES



Totally-enclosed non-ventilated

Dripproof Protected



Totally-enclosed, fan-cooled Frames 256 U and smaller

ELLIOTT Company
CROCKER-WHEELER DIVISION

We will be glad to send a copy of this new booklet describing the complete line of Elliott C-W type N motors. Please write on company letterhead.

W6-6

MASTER PLAN FOR LARGE BUILDINGS

(*Continued from page* 144)

conditioning. Specific projects in which the engineer's advice will be particularly beneficial include overhangs for shading to reduce loads, window sizes, types, locations and materials, equipment location, depth of floor and ceiling spaces for ductwork and location of power supply and water facilities.

He pointed out that costs of air conditioning systems today are about the same as 10 years ago, despite increased labor and material expenses. He estimated the cost for a ton of air conditioning at between $800 and $1100. Increased production, improved design and more experience were cited as reasons for holding the price line ton-wise in air conditioning.

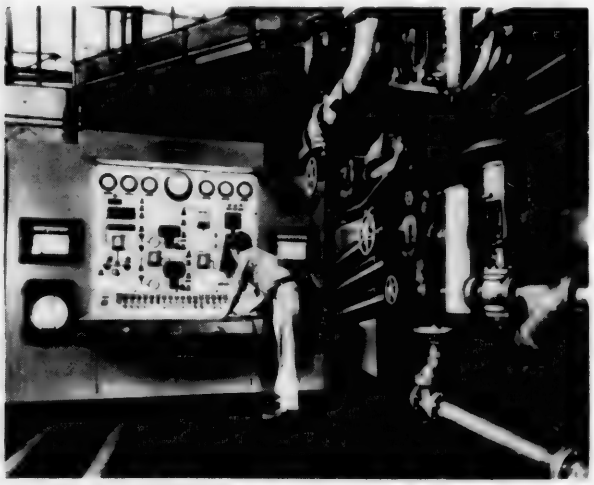
NEW TEST FACILITY

speeds testing of refrigerant compressors under actual field conditions to be encountered by the units.

A new research facility to aid in the testing and development of new products, particularly new compressors for air conditioning and refrigeration, is announced by Worthington Corp. It is a closed circuit test loop with electronic digital computer, installed in the Research and Development Laboratory at Harrison, N. J.

According to Matthew M. Lawler, vice president and general manager of the company's Air Conditioning and Refrigeration Division, this facility with its electronic processing equipment "will enable us to accomplish in hours or a few days what formerly took months."

• **USE**– The test loop was designed to test all compressors with the various commonly used refrigerants. When a new compressor is designed, a working model is built and this model is connected with the test loop. Field test conditions are set up—that is conditions which would be met were the compressor part of an installation in an industrial plant or office building. Compressor performance is measured under these field conditions and the results are fed into an electronic digital computer which is used to tabulate the results.



View of the test loop showing the instrument panel and central control station.

Refrigerant gas is discharged from the compressor being tested through the discharge line and the flow is divided. Part of the gas passes into a shell and tube type condenser where it is liquefied and the balance is further divided between two desuperheaters. One desuperheater cools the gas to a prescribed compressor temperature and the other provides the cooled gas for the interstage flash gas connection of the compressor being tested. Liquid from the condenser flows to the hot wells of the desuperheaters through level-control valves. Hot well pumps deliver the condensate to the desuperheater spray headers.

• **CONTROL PANEL**–The system has a graphic control panel from which a single operator can control and obtain the results of a test run. The panel is a schematic of the test loop with all major components indicated. Mounted on each side of the panel are the direct-reading potentiometers for indicating and recording temperatures, and for direct-reading flow recorders. Final flow calculations are performed by electronic computation.

Mounted on the face of the graphic panel are miniature control indicators which tell at a glance whether the conditions are at the set point or how closely they approach it.

• **COMPUTATIONS**— In all, 603 programmed steps are required to completely evaluate the real fluid thermodynamic relationships of the gas and the performance of the compressor being studied. Data received from the loop tests are punched on cards which, in turn, are fed into the electronic computer.

The electronic computer equipment is in a separate room air conditioned by a packaged air conditioning unit. Because the electronic equipment works best within a narrow temperature range and a large amount of heat is given off by the equipment, air conditioning is necessary.

HEART PATIENTS HELPED

by air conditioning during hot humid weather, Tulane professor reports in medical journal. Also aids aged.

Air conditioning is credited as being of great assistance to coronary heart disease patients by Dr. George F. Burch, Professor of Medicine, Tulane University School of Medicine. Writing in the October issue of the *Journal of Chronic Diseases*, Dr. Burch says:

"The use of the air-cooled oxygen tent and the air-conditioning of hospitals, patients' offices, homes, bedrooms, and automobiles can assist a great deal during periods of hot and humid weather. In fact, during hot weather the cool air of the oxygen tent oftentimes seems to offer more benefit to the patients than the oxygen itself. A cool and comfortable environment not only reduces the stress on the cardiovascular system but also eliminates thermal sweating as a factor in the consideration of water and electrolyte metabolism."

In his summary, Dr. Burch repeats his endorsement of air-conditioning for the heart patient and recommends

(*Continued on page* 148)

why engineers go for Gun-Pakt Expansion Joints

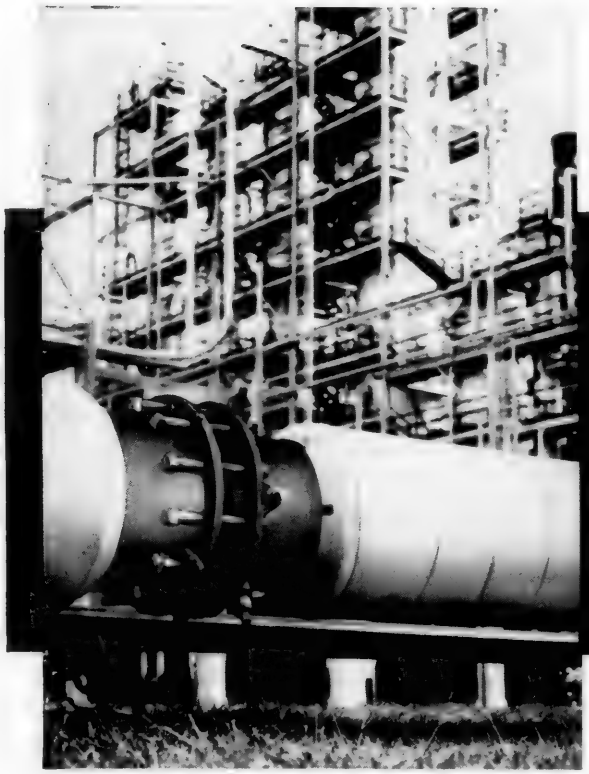
■ Engineers go for Yarway Gun-Pakt Expansion Joints because:

NO SHUTDOWNS. With Gun-Pakt Joints when new packing is needed, it is added under full steam pressure, right on the job—no unpacking, no shutdowns, no service interruptions.

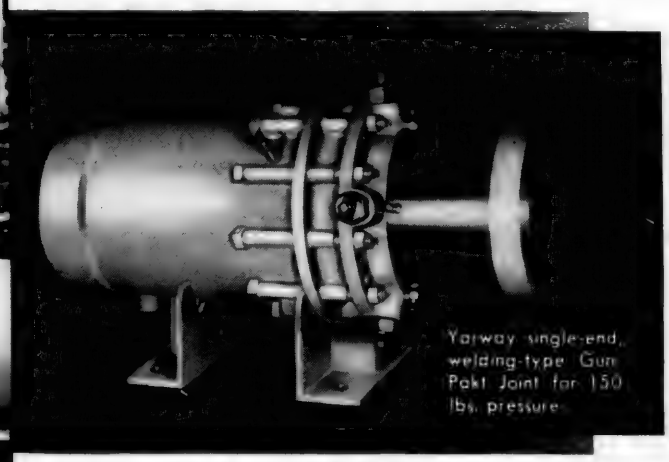
FEWER JOINTS NEEDED. With Gun-Pakt Joints you need fewer joints per length of pipe line, with traverses up to 12" single and 24" double.

LONG SERVICE—NO METAL FATIGUE. Gun-Pakt Joints give long, trouble-free service life—no fatigue failures.

LOW MAINTENANCE. Maintenance records show the costs for servicing Gun-Pakt Joints are very low. One utility reports only 65 cents per year per joint—another reports less than half that.



One of 37 Yarway Gun-Pakt Expansion Joints installed at giant oil refinery on Gulf Coast. Gun-Pakt Joints at this refinery range in size from 1½" to 14".



Yarway single-end, welding-type Gun Pakt Joint for 150 lbs. pressure

Leading institutions, central heating stations and industrial plants "go for Gun-Pakt" again and again. Write now for latest bulletin EJ-1914.

YARNALL-WARING COMPANY
104 Mermaid Avenue, Philadelphia 18, Penna.
BRANCH OFFICES IN PRINCIPAL CITIES

YARWAY GUN-PAKT EXPANSION JOINTS

HEART PATIENTS HELPED

(*Concluded from page* 146)

it for all aged persons as well. He says:

"A hot and humid environment can increase cardiac work as much as strenuous physical exercise. The environment should, therefore, be made comfortable not only for the patient with heart disease but also for aged people and for patients with debilitating states or any illness in which thermal regulation should be facilitated. There is a definite need to consider the hot and humid environment produced by climate, industrial working conditions, or overcrowding of the sickroom in the treatment of all patients in whom it is desired to reduce cardiac work. Greater use of air-conditioning in hospitals, cardiac wards, offices, and homes will assist toward this end."

AIR CONDITIONING RESEARCH

center planned at Purdue to cost $1 million will study effect of cooling on human beings and animals

Representatives of a number of major corporations in the air conditioning, refrigeration, meat processing, farm feed and agricultural industries met at Purdue University, Lafayette, Ind., in mid-September and completed plans for a fund-raising campaign to establish a million dollar research center there devoted to refrigeration and climate control.

• **FUNDS**— The steering committee, formed at the invitation of Purdue President Frederick L. Hovde, endorsed the University plan to study temperature control and its effects on humans and on farm animals. In this program, research activities in numerous areas related to this major topic will be coordinated and controlled under one roof. A half million dollars is already available; $600,000 more is to be raised. The steering committee agreed that the minimum acceptable contribution would be $2,500 a year for the initial three-year period in order to allow as broad representation as possible.

President Hovde explained to the steering committee that the center's real contribution to the economy will be in the form of increasing the supply of trained manpower and contributing to the pool of fundamental knowledge. Not only are these proper aims of the University, he said, but they actually typify the University's role in society.

R. C. McHarness, Kinetic Chemicals, and M. A. Ramsey, Worthington, inspect Purdue hog cooling system

Cooled by refrigerated concrete slab, these Purdue porkers eat and grow fat

• **COMMITTEE**— Chairman of the steering committee is Larry Larsen, general sales manager of Tecumseh Products Company, Tecumseh, Mich., which gave the research center its start a year ago with a contribution of $300,000.

In addition to President Hovde, the committee includes Dr. Roland Bethke, vice-president and research director, Ralston Purina; J. D. Lovely, vice-president, Airtemp Div., Chrysler Corp.; William A. Hanley, vice-president, Eli Lilly and Co., and president of the University's Board of Trustees; William Morgen, district sales manager, Westinghouse Electric Corp.; M. M. Lawler, vice-president, Worthington Corp.; Dudley Chambers, consultant, engineering research services, General Electric; Charles J. Lynn, vice-president, Eli Lilly and Co.; Dr. Roy F. Newton, vice-president and research director, Swift and Co.; A. J. DeFino, vice-president and general manager, air conditioning division, Servel, Inc.; Dr. George Scarseth, American Farm Research Association; George Taubeneck, editor of the *Air Conditioning and Refrigeration News;* Keith Davis, chairman of educational relations committee, Carrier Corp.; M. L. Fortier, Bryant Div., Carrier Corp.; R. C. McHarness, director of research, Kinetic Chemical Division, E. I. du Pont de Nemours; and Larry Larsen, general sales manager, Tecumseh Products Co.

• **OBJECTIVES**— At the meeting Dr. Ralph A. Morgen, assistant to the president for research and research director of the Purdue Research Foundation, outlined the general program for the committee, pointing up the need for fundamental facts in refrigeration and climate control and in the effect of the weather, whether natural or artificial, on humans and on animals of economic importance, such as swine and sheep. Dr. Morgen also stressed the personnel aspect of the Center, noting the current shortage of scientists and engineers faced by the nation, and stressing the fact that this new research program will train engineers and scientists at the graduate

(*Continued on page* 164)

LOOK AT THIS **NEW**
FORCED-DRAFT BURNER
THAT DELIVERS **BIG**
PERFORMANCE

UL LISTED

OIL **syncro** **flame** OIL

FOR COMMERCIAL AND INDUSTRIAL INSTALLATIONS

While this burner *looks* like a standard residential type, it is a *big* heavy-duty machine. Features include two-stage fire, built-in controls for pre-purge, post-purge, and high-low-off fire control with automatic air/fuel ratio settings, terminal strips for accessory wiring, and wide ranges of capacities.

FOR 20 TO 150 H.P. BOILERS HIGH STACK NOT REQUIRED

SYNCRO/FLAME Pressure Burners are capable of firing efficiently into combustion chamber pressures of 3" of water or more, eliminating the need for high stacks or expensive forced draft equipment. *No ordinary burner can do this!* SYNCRO/FLAME Pressure Burners are available for oil, gas, or dual-fuel service.

DETAILS ON REQUEST
Write today for data sheets describing all features and giving full specifications.

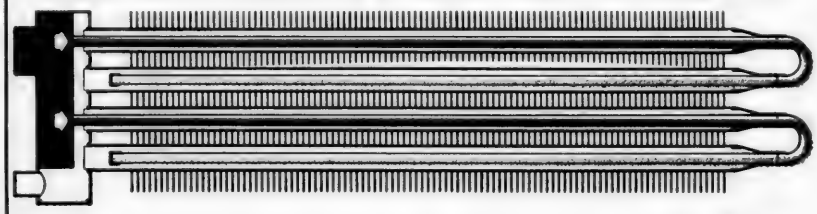
MANUFACTURERS OF OIL AND GAS AND OIL/GAS BURNERS
SYNCHRONOUS FLAME, INC.
WALWORTH • WISCONSIN

Nesbitt Series T Surface assures uniform discharge temperatures

If a coil will not deliver uniform temperature across its full length under modulated steam supply, you can expect uneven heating from the ducts. The only positive cure for this problem is to install Nesbitt Series T Surface with Trombone Steam Distributing Tubes.

Unlike conventional surface, Nesbitt Series T Surface employs the exclusive Trombone distributing tubes, each of which serves two adjacent condensing tubes from a single supply connection. Steam must travel across the first leg of the trombone tube (the full length of the surface) before reversing, under increased demand, to serve the second leg. Results: uniform discharge temperatures; maximum freeze protection; perfect controllability.

Nesbitt Series T Surface with Trombone Steam Distributing Tubes



Nesbitt HEATING SURFACE
WITH THE TROMBONE STEAM DISTRIBUTING TUBES
Made and sold by John J. Nesbitt, Inc., Phila. 36, Pa. Ask for Publication 305

NEW CATALOGS

Use the prepaid postcard on page 121 for securing your copies of catalogs described in this department.

SPLIT CAPACITOR FAN MOTORS — Type KCP, permanent split capacitor fan motors for room air conditioners, 35 mhp to 1/6 hp, is described in an 8-page bulletin (GEA-6533), issued by General Electric Co., Schenectady, N. Y. The motor's speed versatility, low temperature rise, and high power factor is discussed. .....**Item 42**

HOT WATER PIPING SYSTEMS—An 8-page booklet, Form 600-A9, is released by Herman Nelson Unit Ventilator Products, American Air Filter Co., Inc., Louisville, Ky. The booklet illustrates the advantages of three methods of hot water perimeter piping systems, wall mounted, cabinet base, and recessed edge, for use with classroom unit ventilators. .....**Item 43**

COOLING DATA SHEETS—Data sheets (EMP-56110) for those who specify or install air conditioning and commercial refrigeration equipment are offered by Drayer-Hanson Div., National-U. S. Radiator Corp., Los Angeles, Calif. Graphic diagrams detailing typical wiring, multiple circuits, and outdoor installations, are given in addition to a table of dimensions, performance curves, and selection of worked-out problems. .....**Item 44**

INSTRUMENTATION LITERATURE—Bulletin G-2 is an index of instrumentation literature published by Industrial Div., Minneapolis-Honeywell Regulator Co., Philadelphia, Pa. It covers catalogs, bulletins, specification sheets, data sheets, illustrated lectures, and text. .....**Item 45**

VIBRATION AND NOISE CONTROL—An 8-page publication, K7A, aimed at increasing production through effective vibration and noise control is offered by The Korfund Co., Long Island City, N. Y. The bulletin shows by means of authentic case histories how profits and production can be increased through the modern concept of using machinery mountings designed for the control of vibration and noise. .....**Item 46**

PSYCHROMETRIC CHARTS—A pad of psychrometric charts is offered by Young Radiator Co., Racine, Wis., for figuring heating, cooling, and air conditioning problems. An explanation of the chart and sample problems making use of it are contained on the reverse side. .....**Item 47**

WELDING FITTINGS—A 6-page folder, FB-502, released by the Tubular Products Div. of The Babcock & Wilcox Co., Beaver Falls, Pa., describes the company's full line of carbon, alloy and stainless steel seamless welding fittings and forged flanges. ..**Item 48**

PACKAGED AUTOMATIC BOILERS — Bulletin 1233, describing 8-25 hp packaged automatic boilers for steam or hot water heating and hot water service, is available from Orr & Sembower, Inc., Reading, Pa. The oil or gas firing burners for heating and low pressure process applications in industrial plants, apartments, churches, garages and service stations, greenhouses, hospitals and institutions, motels, office buildings, schools, and warehouses, are illustrated in detail. Dimensions, weights and ratings for the various models are given .....**Item 49**

GAS DETECTION EQUIPMENT — Combustible gas detection equipment is the subject of a new specification sheet offered by Johnson-Williams, Inc., Palo Alto, Calif. The sheet describes the company's Sentinel and Sample Drawing Sentinel units for gas detection, and testing. ....**Item 50**

WALL REFERENCE CHART—A Three color, 24 x 38 in. wall chart illustrating and describing the more than 81 items in a unit cartoned line of standardized pipe, duct and fittings for residential heating and cooling installations has recently been printed by Adelta Mfg. Co., Inc., Philadelphia, Pa. The reference guide which can be hung on walls or doors makes it easier for contractors to determine their needs and sizes and to order directly from the chart since all the necessary information is displayed in full view in one place. .....**Item 51**

YEAR-ROUND ROOM CONDITIONERS—New fan and coil room air conditioners for year-round service in hotels, office buildings, hospitals, schools, and practically any other type of multi-story building is described in Bulletin C-1100-B88P, released by Worthington Corp., Harrison, N. J. .....**Item 52**

DEHUMIDIFIERS—Bulletin C-1100-B90 is prepared by Worthington Corp., Harrison, N. J., to present information on the Worthington sprayed coil surface dehumidifiers for use with central station systems. This type unit is available in 241 sizes to deliver from 1000 to 60,000 cfm for comfort cooling and industrial applications. .....**Item 53**

INDUSTRIAL ROOF EXHAUSTERS—Illustrations, performance ratings, and diagrams of its high-velocity industrial roof exhauster is contained in Bulletin CH-101 issued by Chicago Blower Corp., Franklin Park, Ill. The 4-page bulletin explains the operational principles behind the fan's automatic damper blades, high velocity exhaust capability, and fusible link fire safety device. .....**Item 54**

SPACE HEATING UNITS — A 12-page bulletin describing and illustrating its line of convectors, baseboard heaters and unit heaters is issued by Beacon-Morris Corp., Boston, Mass. Tables are included to show the heat output for the various units. .....**Item 55**

(*Continued on page* 152)

G-B SNAP*ON DISTRIBUTORS

(See ad on facing page)

ALBUQUERQUE, Mt. States Insulation Co.
AMARILLO, Ball Distributing & Engr. Co.
APPLETON, J. D. Wilson Co.
BILLINGS, Mont., L. W. Worthington
BIRMINGHAM, Ala., Shook & Fletcher Supply
Southern States Iron Roofing Co.
BROOKLINE, Mass., Homans-Kohler, Inc.
BUFFALO, Frontier Insulation & Supply Co.
CHARLESTON, W. Va., Baldwin Asbestos Products Co.
CHARLESTON HEIGHTS, S. C., Stafford Insulation Co.
CHICAGO, E. C. Carlson Co.
CINCINNATI, R. E. Kramig & Co.
CLEVELAND, The Miles Materials Co.
COLUMBIA, S. C., Southern States Iron Roofing Co.
COLUMBUS, Santeler Brothers
DALLAS, Insulation Supply Co., Inc.
DAVENPORT, Republic Electric Co.
DENVER, Gene Wright Lumber Co.
DETROIT, Coon-DeVisser Co.
EL PASO, Insulation & Specialties Co.
FARGO, N. D., Smith, Inc.
FT. SMITH, Ark., Gunn Distributing Co.
FT. WAYNE, Ind., M. H. Hilt, Inc.
FT. WORTH, The Bracken Co.
GREENSBORO, N. C., Starr Davis Co., Inc.
HOUSTON, Precision Insulation Co.
INDIANAPOLIS, Central Supply Co.
IRON MOUNTAIN, Mich., Champion, Inc.
JACKSON, Miss., Machinery Sales & Service Co., Inc.
JOPLIN, Mo., Joplin Cement Co.
KANSAS CITY, Kelley Asbestos Co.
LITTLE ROCK, Gunn Distributing Co.
LOS ANGELES, Western Fibrous Glass Products
Plant Insulation Co.
LOUISVILLE, General Insulation & Roofing Co.
MADISON, Wis., J. D. Wilson Co.
MEMPHIS, John A. Denie's Sons Co.
MIAMI, Southern States Iron Roofing Co.
MILWAUKEE, J. D. Wilson Co.
NASHVILLE, Southern States Iron Roofing Co.
NEW HAVEN, Conn., Insulation Supply Co.
NEW ORLEANS, Eagle Asbestos & Packing
NEW YORK, Eastern Steam Specialty Co.
OKLAHOMA CITY, Ball Distributing & Engineering Co.
OMAHA, Cardinal Supply & Mfg. Co.
PHILADELPHIA, John F. Scanlan, Inc.
PITTSBURGH, D. J. Kennedy Co.
PHOENIX, Ariz., Kircher Asbestos & Rubber Co.
RALEIGH, N. C., Southern States Iron Roofing Co.
RICHMOND, Va., Southern States Iron Roofing Co.
ROCKFORD, Ill., Mott Brothers Co.
SALT LAKE CITY, Bullough Asbestos Supply Co.
SAN ANTONIO, The Bracken Co.
SAN DIEGO, Western Fibrous Glass Products
SAN FRANCISCO, Western Fibrous Glass Products
SAVANNAH, Ga., Southern States Iron Roofing
SCHENECTADY, N. Y., Jon Tree Sales & Supply Co.
SEATTLE, Western Fibrous Glass Products
ST. LOUIS, A. G. Brauer Supply Co.
ST. PAUL, Asbestos Products, Inc.
SYRACUSE, N. Y., Industrial Supply Co.
TAMPA, Fla., Eagle Roofing & Art Metal Works, Inc.
TALLAHASSEE, Fla., Capital Refrigeration & Supply
TULSA, Okla., Ball Distributing & Engr. Co.
WASHINGTON, Walter E. Campbell Co., Inc.
WICHITA, Jamar-Olmen Construction Co.
VANCOUVER, B. C., Fleck Brothers Limited

GUSTIN BACON gb

It's a cinch it's SNAP*ON... "the last word" in pipe insulation

No other pipe insulation is so easy and inexpensive to handle and apply as this unique one-piece pipe insulation molded of fine glass fibers! Lightweight, resilient and rugged, Snap*On is virtually unbreakable — a fact that permits workers to handle and apply it with unprecedented ease and speed. Other advantages:

- **Highest thermal efficiency** of any insulation for cold or hot piping up to 350°.
- **Lowest applied cost** — just spread the single seam and it snaps on the pipe.
- **Permanent** . . . yet reusable.

Available plain or jacketed, in 3′ or 6′ sections in sizes up to 33″. Local stocks maintained by a nation-wide network of distributors. **See adjoining column for local distributor.**

GUSTIN-BACON

Manufacturing Company GUSTIN gb BACON

Thermal and acoustical insulations • Pipe couplings and fittings

222 W. 10TH ST., KANSAS CITY, MO.

←See Adjoining Column for Local Snap*On Distributor

"K" Fittings are this man's *favorites...*

He likes to have "K" fittings supplied on the job for several reasons:

1. K's are easy to start because of the chamfered entrances; also damage to threads is avoided.
2. K's run up quickly and make tight joints because the threads are full and clean.
3. Because of the strong and uniform walls, K's don't crack under strain.

He likes these features which save time and grief. They are features to which we give special attention in our manufacturing and inspecting procedures.

You are invited to send for the "K" condensed catalog for reference.

THE KUHNS BROTHERS CO.

1800 McCALL ST. • DAYTON 1, OHIO

Established 1887

NEW CATALOGS

(*Continued from page* 150)

Use the prepaid postcard on page 121 for securing your copies of catalogs described in this department.

HEAVY DUTY CENTRIFUGAL FANS—An illustrated 8-page catalog (Bulletin 4824) describes the new Airfoil centrifugal fans for heavy duty industrial applications. Available from American Blower Corp., Detroit, Mich., the publication discusses performance and construction details of the fans, supplemented with photos and drawings of wheel, housing, bearings, shaft, bearing supports and inlet screens, and several possible volume control methods that can be used. Brake horsepower curves for four volume control methods which compare the power requirements at varying degrees of fan delivery for damper control, vane control, variable speed a-c motor control, and adjustable speed fluid drive control included . . . **Item 56**

ELBOW LOSSES IN AIR SYSTEMS—Information on its factory-fabricated, ready-to-install air turning device, designed to give sweeping radius performance to the square duct corner, is presented in Catalog F 7912 of Barber-Colman Co., Rockford, Ill. Pressure loss data which permits engineers to determine the true elbow losses throughout the air distribution system and sizing and ordering information are included. . . . . **Item 57**

GLASS INSULATION APPLICATION—Intended as both catalog and reference booklet for architectural, engineering and maintenance personnel, a 24-page illustrated data booklet (FB-101) contains information on the latest recommended procedures for the application of cellular glass insulation on flat roofs, pitched roofs, parking decks, curtain walls, core walls, wall linings, and ceilings. It is published by the Pittsburgh Corning Corp., Pittsburgh, Pa. . . . . **Item 58**

DESIGN INSTRUMENTS AND AIDS—A 15-page catalog, Form 3547, is available from Way-Mac Mfg. Co., Los Angeles, Calif. It describes design instruments, slide rules, and varieties of drafting templates obtainable from this company. . . . . **Item 59**

ULTRA FILTRATION DESCRIBED—Specially adapted industrial cloth filter type dust collectors for cleaning ordinary atmospheric air is treated in Bulletin No. 557-D published by Wheelabrator Corp., Mishawaka, Ind. The ultra filtration process is described in two case histories of installations where this process is used for cleaning dust out of ordinary city or country air. . . . . **Item 60**

(*Continued on page* 154)

before

after

Modern Dravo heating saves this plant $6732 per year, frees 3400 sq. ft. of floor space

Sharp increases in heating costs traveled hand-in-hand with growth and expansion at Ideal Electric and Manufacturing Company's Mansfield, Ohio plant.

As manufacturing additions went on over the years, more and more hand-fired coal stoves were employed to heat new areas. Until recently, heating for the seven-acre plant area was handled by thirty-two such units. Heating problems never seemed to cease. With the lack of uniformity in heating, workers either froze or baked. Coal and labor costs (it took almost the full time of 5 men to fire stoves around the clock) never stopped climbing. Stoves and their bins gobbled up more than 4000 square feet of plant space!

When modern Dravo gas-fired, forced-air space heaters were installed, these problems disappeared, and the savings were immediate and substantial. Since eleven Dravo "Counterflo" heaters provided comfortable heat everywhere in the plant areas, 3400 square feet of valuable space was released ("Counterflo" heaters required only 600 square feet). But, more important was the actual gross savings of $6732 made possible last winter, '54-'55, through the use of these Dravo Heaters. When amortizing this new and standby equipment over a 10 year period, a net savings of $2735 per year is realized!

Remarkable? Then you will want to see for yourself what unusual cost-savings and heating efficiency Dravo heaters can bring to your heating systems. Use the coupon below to get complete details. You'll find it always pays to investigate Dravo Heaters!

Dravo Corporation, Department A-3911
Fifth & Liberty Avenues
Pittsburgh 22, Pa.

I am interested in Dravo Heaters for _____

☐ Please send literature
☐ Please have representative call

DRAVO
CORPORATION
Pittsburgh 22, Pennsylvania
Representatives in all principal cities

Name _____

Company _____

Address _____

City _____ Zone _____ State _____

Now! 5-10 minute conversion to other gases

No change in burner . . . no costly control alterations with Modine gas unit heaters

ONLY the new Modines provide this important versatility. Inexpensive conversion kit with easy-to-follow instructions now permits quick conversion from natural to LP, LP-air, or mixed gas. Units installed to burn other than natural gas can be easily converted when natural gas becomes available.

And because a single Modine unit can be converted to burn any of these gases, your jobber can always supply your need without waiting for shipments from the factory. Whatever your gas requirement, Modine jobber stocks are always in balance — thanks to quick and inexpensive conversion.

Get full details on all the other outstanding Modine features. Call the Modine representative listed in your classified phone book.

Get your copy of this bulletin on Modine Gas Unit Heaters. Tear out coupon and mail today.

Modine
GAS UNIT HEATERS

MODINE MFG. COMPANY
1511 DeKoven Ave., Racine Wis.

Please send me free Bulletin 656.

NAME .....
FIRM .....
ADDRESS .....
CITY ..... ZONE ..... STATE .....

GU-1337

NEW CATALOGS

(*Continued from page* 152)

Use the prepaid postcard on page 121 for securing your copies of catalogs described in this department.

COOLING TOWER SELECTION — A method for selecting cooling towers or for determining performance under varying conditions is offered in Catalog 32C6a by Refrigeration Engineering, Inc., Los Angeles, Calif. Charts and tables provide a graphical method for selecting a tower from conditions given, or if the tower size is known, the final water conditions can be determined. Also included are a head loss and conversion chart. . . . . **Item 61**

PIPE INSULATION—A 40-page catalog on Unibestos pipe insulation is offered by Union Asbestos & Rubber Co., Bloomington, Ill. Designed as a convenient reference guide, the new catalog presents a new way to specify proper thickness for pipe insulation based on a J factor. This special index eliminates much of the complicated computation formerly required to determine thicknesses. . . . . **Item 62**

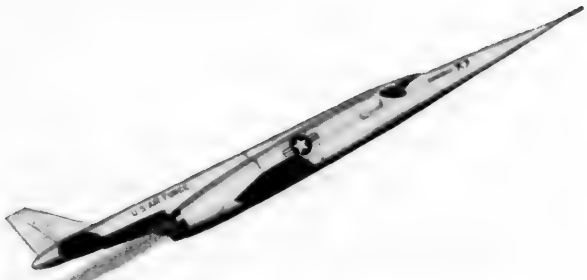
GAS ADSORBTION WITH CHARCOAL—How activated charcoal made from coconut shells can be used effectively for air recovery, odor removal, air purification, food preservation and as a solvent recovery is the subject of a catalog issued by Barnebey-Cheney Co., Columbus, Ohio. It is divided into three sections that deal with equipment, applications and the charcoal itself. Illustrated technical sheets, magazine reprints, cartoons and detailed reports are included. . . . **Item 63**

UNIT HEATER APPLICATION—Proper selection of vertical, cabinet, and horizontal unit heaters is the subject of a 12-page bulletin, No. 14, of Industrial Unit Heater Assn., Detroit, Mich. Typical commercial and industrial installations are illustrated. . . . . **Item 64**

OUTDOOR WEATHER CONTROLS — A chart scheduling the most suitable outdoor controls for use with different types of heating systems under varying conditions and requirements has been prepared by Automatic Devices Co., Western Springs, Ill., as Bulletin N-756. This chart, together with guide specifications prepared in outline form and scheduled separately for various types of heating systems and requirements are included. . . . **Item 65**

IMMERSION WATER HEATERS—Blast immersion water heaters designed for reduced sound level of operation is the subject of 4-page Bulletin 5201 issued by Sellers Engineering Co., Chicago, Ill. Some of the subjects discussed are immersion firing, copper clad tubes, and design. . . . . **Item 66**

(*Continued on page* 156)



ENGINEERING

—countless hours of engineering effort—is what made the X-3, Douglas Aircraft's sleek, new, supersonic research ship possible. Like the X-3, Western Engineering and Manufacturing's line of ventilators is the result of careful, skilled engineering.

Both have gone through several wind-tunnel-tested design stages, to ensure their superior performance under operational conditions.

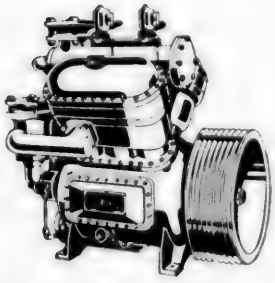
Although engineering and performance data on the X-3 is classified and unavailable, complete engineering data on Western's line of ventilators can be obtained from your local jobber or by mailing to:

WESTERN ENGINEERING & MFG. CO.

4114 GLENCOE AVE., VENICE, CALIF.

TRADE FRICK MARK®

Air Conditioning Serves Throughout this Unique Hotel



Nine Frick "ECLIPSE" Compressors Air-Condition the Claypool Hotel at Indianapolis

Famed as the first COMPLETELY air-conditioned large hotel north of the Mason-Dixon Line, the Claypool at Indianapolis selected Frick equipment because it had used Frick Refrigeration for food service since 1939.

Nine Frick "ECLIPSE" compressors, installed by Decker and Roberts of Fort Worth, carry the air conditioning load, which is divided into three systems.

You get the utmost in air conditioning, ice making, quick freezing and cooling services when you specify "Frick." Let us quote now on your commercial or industrial cooling needs.

FRICK COMPANY • WAYNESBORO, PENNA.

Here's How to Get

MORE WORK from Steam Equipment!

● Bring your steam-using production units up to maximum work capacity in one-eighth the time it now takes. Add a full production cycle per day to kettles, autoclaves, dryers, heaters, etc! Equip all production units with the Heat-Kwik Super-Silvertop steam traps. A new combination open float and thermostatic design enables these traps to purge all air from cold units at once so that unvented air cannot mix with steam entering steam compartment, thereby reducing the temperature and acting as heat insulator. Get more production. Install Heat-Kwiks. See your jobber or mail coupon for further information.

THE NEW WAY
Notice the simplicity and saving in fittings.

THE OLD WAY
Notice how bottom inlet requires complicated piping.

FREE HEAT-KWIK BULLETIN!
Bulletin 1153 contains prices, capacities and specifications on Heat-Kwiks. For your copy fill out and mail to:

THE V. D. ANDERSON COMPANY
Division of International Basic Economy Corporation
1973 West 96th St. • Cleveland 2, Ohio

Name _____
Company _____
Address _____
City _____ State _____

SUPER-SILVERTOP

NEW CATALOGS

(*Continued from page* 154)

Use the prepaid postcard on page 121 for securing your copies of catalogs described in this department.

FEEDWATER DE-OXIDIZER — Use of Scav-Ox, a 35% hydrazine solution for removing dissolved oxygen from boiler feedwater, is described in a 16-page illustrated booklet available from the Industrial Chemicals Div., Olin Mathieson Chemical Corp., Baltimore, Md. It discusses determination of dosage, recommended methods of application, testing methods for hydrazine, and properties and handling of the material. Comprehensive operating data are presented in the form of case studies in each of the three boiler classes. .....**Item 67**

TUBULAR PIPES AND FITTINGS—Technical information on pipe, tubes, and welding fittings made of an intermediate chromium molybdenum alloy steel, Croloy 5, for elevated temperature service is contained in Bulletin TDC-146A, issued by Tubular Products Division of The Babcock & Wilcox Co., Beaver Falls, Pa. ....**Item 68**

AIR POLLUTION CONTROL—A 4-page brochure, Tools and Techniques in Air Pollution Control, has been prepared by the staff of Hemeon Associates, air pollution consultants, Pittsburgh, Pa. It is devoted to a description of scientific methods available for the study of various aspects of air pollution and which are a part of the consultation service offered by this organization. It includes discussion of pilot scale research, testing and design; tall stack dispersion analyses by model wind tunnel and micrometeorological studies; new-plant surveys; dust collector and fly ash arrestor acceptance testing; particle size measurements in dust collector and air cleaner applications; stack emission surveys; stack gas tracer studies; and community surveys for ordinance and zoning development. .....**Item 69**

DIRECT-CURRENT APPARATUS—A 32-page booklet dealing with direct-current motor drives is being offered by General Electric Co., Schenectady, N. Y. The non-promotional booklet, published as an answer to the trend of opinion that direct-current is out moded, presents the many advantages and applications of this type of electrical power as related to automation and future production. .....**Item 70**

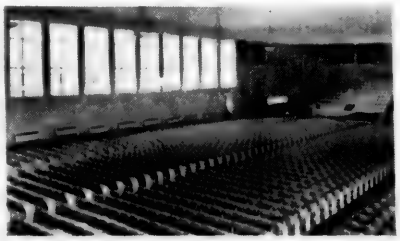
CEILING DIFFUSERS—A new bulletin No. CD-56, offered by The Auer Register Co., Cleveland, Ohio, describes the company's line of step-down ceiling diffusers. Incorporated in the bulletin are complete engineering data for easy sizing and application as well as list prices for the diffusers, dampers and frames. .....**Item 71**

(*Concluded on page* 158)

If your new building or remodeling calls for

low-cost heat • beauty • versatility

Only inlet and outlet grilles are visible as Type BT Modine Cabinet Units concealed in walls heat the modern office building lobby.

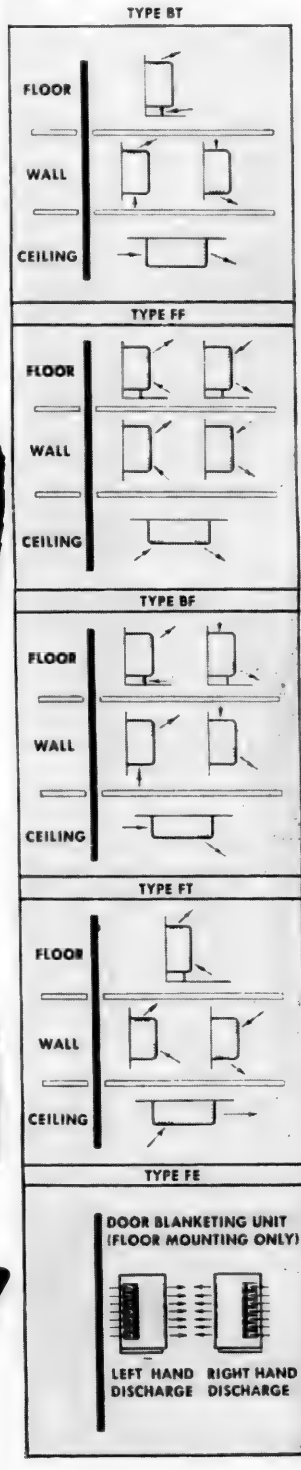


68 Modine cabinet units heat this church.

Cabinet units on ceiling save wall space.

20 Variations

to match your individual room requirements



... make *Modine* Cabinet Units your choice

With Modine Cabinet Units it's easy to select the right capacity, style, performance for any hot water or steam heating requirement. You have a choice of 20 variations for upright or inverted installation . . . fully exposed, recessed or concealed . . . on floor, wall or ceiling. And sizes range from 120 to 640 Edr.

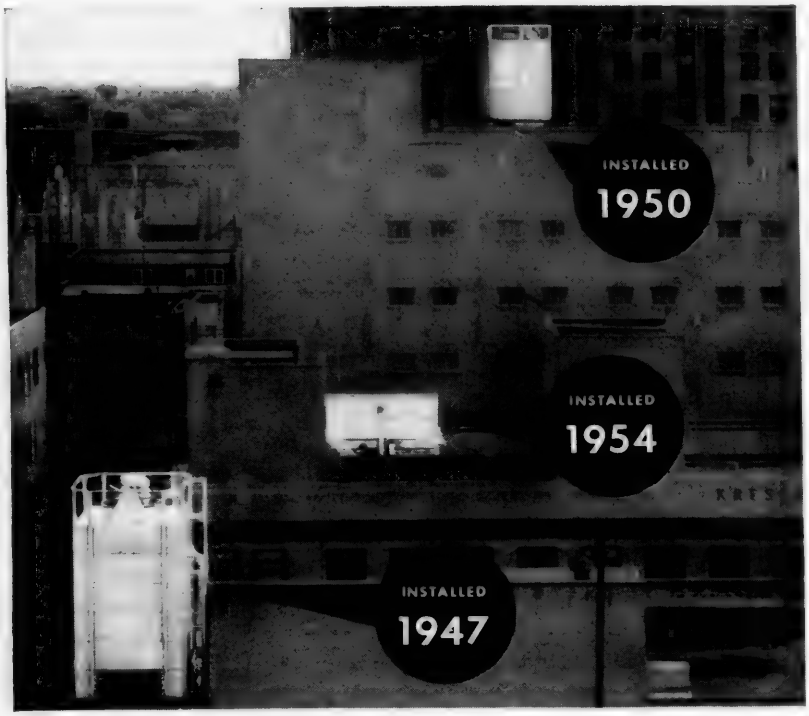
Some units heat with hot water . . . cool with chilled water. All models can be installed with or without ducts. Using inexpensive accessories, Modine Cabinet Units ventilate with outside air. What's more, they cost less to install than individual unit ventilators or air conditioners.

Smartly styled Modine Cabinet Units provide unmatched heating and installation flexibility . . . for commercial, institutional, public buildings. See the Modine representative listed in your classified phone book, or write to Modine Mfg. Co., 1511 DeKoven Ave., Racine, Wis., for Bulletin 552.

C-1316

Modine CABINET UNITS

In Canada: Sarco, Ltd., Toronto



Located side by side, three major Flint, Michigan, department stores employ Binks cooling towers to help maintain store temperatures at 71°

3 cooling towers, 1 story... high performance-low maintenance

These 2-K and 3-B Series Binks cooling towers give good service with practically no maintenance, according to the service engineers for the stores.

What makes Binks cooling towers dependable performers?

High Efficiency. Binks patented Rotojet spray nozzles plus internal redwood decking assure a thorough water break-up. Scientifically balanced air-to-water ratio gives high cooling efficiency under all climatic conditions.

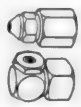
Minimum Maintenance. All parts are built to Binks rigid specifications. Panels and structural framework are heavily galvanized and coated. Blowers for 3-B towers are hot-dipped galvanized; 2-K Series fans are corrosion-resistant aluminum alloy. All parts are designed for easy erection and access—factors appreciated by those who assemble and maintain them.

Send for complete data

Write direct to the address below for Bulletins 477 and 333 describing 2-K or 3-B Series towers. Binks engineers will gladly study your needs and help you select the right tower from a complete line of mechanical and natural draft units.

649

Binks
EVERYTHING FOR WATER COOLING



A COMPLETE LINE OF NATURAL DRAFT AND MECHANICAL DRAFT COOLING TOWERS AND INDUSTRIAL SPRAY NOZZLES

Binks Manufacturing Company

3120-38 Carroll Ave., Chicago 12, Ill.

REPRESENTATIVES IN PRINCIPAL U.S. & CANADIAN CITIES • SEE YOUR CLASSIFIED DIRECTORY

NEW CATALOGS

(*Concluded from page* 156)

AIR CONDITIONING BULLETIN—A 12-page bulletin featuring new products has been issued by Anemostat Corp. of America, New York, N. Y. Products included in the bulletin are a remote manual control, a ceiling panel-diffuser, a straight line 100% aspiration diffuser, a high capacity vane type diffuser for high sidewall installation, diffusers for ceiling mounting with center induction and radial distribution, and diffiusers with air extraction in the outer cones. The bulletin is illustrated with performance charts, photographs and drawings, with information on each product. .....**Item 72**

ROOF EXHAUSTER GUIDE—A buyers guide for evaluating power roof exhausters is available from Gallaher Co., Omaha, Neb. The booklet gives explanations on eleven cardinal points to be considered in the purchase of power roof exhausters. .....**Item 73**

HEATING PUMP BULLETIN—A 4-page illustrated bulletin (No. H-1) describing the design and construction features of single and duplex condensate return pumps is offered by C. H. Wheeler Mfg. Co., Economy Pump Div., Philadelphia, Pa. The folder includes photos, dimension drawing, selection and operating data. ...**Item 74**

THERMOSTATIC CONTROL VALVES—An engineering specification handbook, Bulletin M-3, has been issued by Lawler Automatic Controls, Inc., Mt. Vernon, N. Y., to aid design engineers and contractors in determining the correct selection and installation requirements of items in the company's line of thermostatic control valves for use in institutional applications. Performance graphs, roughing-in diagrams, and piping layouts are presented to give complete information on the temperature control of liquids and steam. .....**Item 75**

COOLING TOWER CATALOG—A 12-page catalog (No. 400) with information and specifications on a line of packaged cooling towers is offered by Dover Mfg. Co., Independence, Mo. Included in the catalog are specifications, dimensions, capacity tables, and engineering data. .....**Item 76**

OIL FIRED STEEL BOILER — The Mark III Packet, the newest addition to the company's line of heating units, is described and illustrated in Catalog 842 issued by National-U. S. Radiator Corp., Johnstown, Pa. The catalog presents the design, construction, installation and operation features claimed for the factory-assembled, oil fired heating plant. .....**Item 77**

Use the prepaid postcard on page 121 for securing your copies of catalogs described in this department.

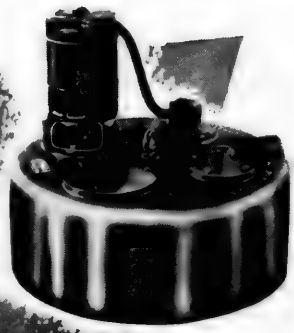
THE **weil** TVC

New 26 Gallon TVC Receiver

Condensate Pumps

- LOW RETURN CONNECTION
- LOW SPEED — LONG LIFE
- CAST IRON RECEIVER
- LOW WATER LINE

Capacities to 15,000 sq. ft. E.D.R.



Features:

Low speed (1750 RPM) TVC pumps are easily installed in areas where space is important. Their compact cast iron receiver and sturdy pumping unit assure a trouble-free installation.

Dimensions:

26 gallon cast iron receiver for single or duplex units: Diameter 25"; height of return above floor 10½"; height of unit 36" max.

Installation:

Simple installation: one return connection, one discharge connection. Unit is completely assembled at the factory. Send for Bulletin TVC-300.

Send for Bulletin TVC-300

Available from Jobbers Stocks!

TVC PUMPS now available in capacities from 750 to 15,000 sq. ft. E.D.R.

The three sizes of TVC receivers now offer a complete line of low pressure system condensate pumps to fit all requirements. The LOW RETURN CONNECTION and LOW SPEED — 1750 R.P.M., coupled with the built-in durability, operating efficiency and low cost of these pumps guarantee a satisfactory and trouble free installation. This pump provides gravity drainage for low heating units.

Specify and install a **weil** TVC Pump.

Built for ONE MILLION STARTS . . . without attention

1516 North Fremont Street • Chicago 22, Illinois

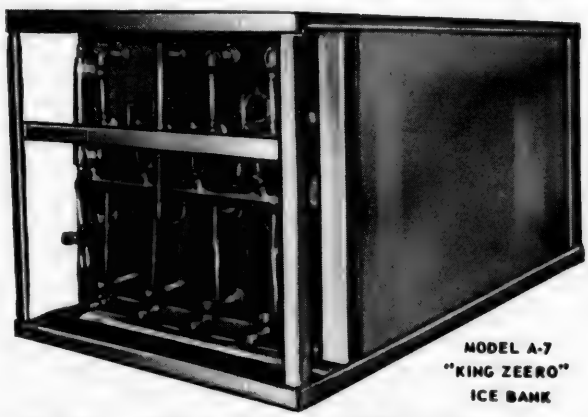
"King Zeero's" Sweet Water ICE BANKS offer ICE-CONCENTRATED Refrigeration for Air Conditioning

CONTINUOUS RIFLED GALVANIZED COILS
EXPANSION VALVE CONTROLLED

32°-34° COLD ICE WATER

DESIGNED FOR USE WITH:
FREON — METHYL CHLORIDE — AMMONIA

The "King Zeero" ICE BANK is designed for air cooling in Churches, Mortuaries, Theatres, Offices, Stores, Auditoriums, Factories, Clubs, Restaurants, etc. Ice Banks may be added to existing systems for increased capacity.



MODEL A-7
"KING ZEERO"
ICE BANK

The "King Zeero" ICE BANK is designed to deliver tons of 32 to 34 F. ice water for recirculation through air cooling coils. Peak loads many times compressor capacity are easily handled.

- DIRECTED COURSE OF WATER travels with "built-in" agitation.
- NO MECHANICAL AGITATION REQUIRED.
- LARGE WATER COMPARTMENTS spaced on 11" and 12" centers.
- 33% EXTRA ICE CAPACITY safely attained without freezing up.
- ICE IS "BURNED OFF" PLATE COILS progressively, exposing prime and secondary surface for maximum flash cooling capacity.
- ICE THICKNESS automatically controlled - eliminates "freeze ups."
- 94 SIZES to fit space requirements. Other designs for special applications.

CAPACITIES - 500 lbs. to 30,000 lbs. (72,000 B.T.U.'s to 4,320,000 B.T.U.'s) in a single unit. Multiple units may be installed.

MAIL COUPON TODAY

King Zeero Co., 4302 W. Montrose Ave., Chicago 41, Ill

☐ Please send me your new ICE BANK Catalog.

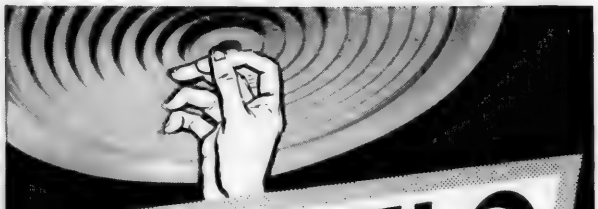
Name _____

Address _____

City _____ State _____

THE KING ZEERO COMPANY

4300-14 W. Montrose Ave., Chicago 41, Ill.



FLEXIFLO

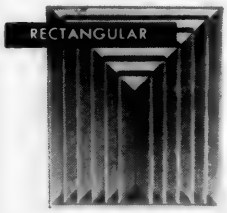
The Diffuser for Every Application

Here's the complete diffuser line with all extra features: built-in equalizing deflectors; easy to install; quick adjustment of air volume and diffusion pattern; simplified engineering; beautifully finished in any color baked enamel.

Let our sales engineers show you why Flexiflo is better for your jobs. But first — get the Flexiflo catalog.

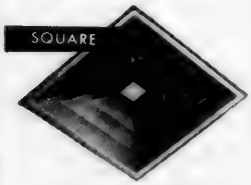
Type R, constant flow pattern regardless of volume adjustment.

Type V, fully adjustable air diffusion pattern and volume.



Type MP, for 1-, 2-, 3- or 4-way diffusion to accommodate any shaped area, 16 styles.

Type CH, adjustable for heating, ventilating and cooling.



Type H, adjustable volume, constant pattern and radius of diffusion.

Type S, side wall or ceiling, with Type R or V blades for heating or cooling.

Return this coupon

UNIVERSAL DIFFUSER CORP.
38 Marbledale Road, Tuckahoe, N. Y.

Please send me complete catalog HV

NAME_____

COMPANY_____

STREET_____

CITY_____ ZONE_____ STATE_____

Canadian Degree Days for September, 1956*

City	September 1956	September Normal	Cumulative 1955	Cumulative Normal
Calgary, Alta.	428	432	428	432
Charlottetown, P. E. I.	306	222	306	222
Crescent Valley, B. C.	329	360	329	360
Edmonton Alta.	447	444	447	444
Fort William, Ont.	508	354	508	354
Grand Prairie, Alta.	524	480	524	480
Halifax, N. C.	248	189	248	189
London, Ont.	284	126	284	126
Medicine Hat, Alta.	295	267	295	267
Moncton, N. B.	383	282	383	282
Montreal, P. Q.	316	180	316	180
North Bay, Ont.	467	264	467	264
Ottawa, Ont.	349	204	349	204
Penticton, B. C.	192	213	192	213
Prince George, B. C.	478	444	478	444
Quebec City, P. Q.	402	276	402	276
Regina, Sask.	420	408	420	408
St. John, N. B.	370	270	370	270
Saskatoon, Sask.	441	396	441	396
Timmins, Ont.	507	405	507	405
Toronto, Ont.	252	168	252	168
Vancouver, B. C.	247	234	247	234
Victoria, B. C.	299	264	299	264
Windsor, Ont.	184	54	184	54
Winnipeg, Man.	439	330	439	330

*These data are supplied through the courtesy of the Meteorolcgical Division Air Service Branch, Department of Transport, Canada.

BOOK REVIEWS

Publications abstracted in this department should be ordered direct from publisher.

MECHANICAL ENGINEERING PRACTICE

The fifth edition of Mechanical Engineering Practice is now available. It is a laboratory reference text by Charles F. Shoop, emeritus professor of mechanical engineering, University of Minnesota, and George L. Tuve, professor of mechanical engineering, Case Institute of Technology.

As compared with the previous edition, new material has been included in each chapter, and special emphasis is placed on new techniques for mechanical measurements, dynamic characteristics of processes and automatic control. There is a new chapter on electromechanical instrumentation.

Included is a suggested list of experiments for laboratry courses grouped according to the various laboratories available in schools.

Mechanical Engineering Practice, by C. F. Shoop and G. L. Tuve. Cloth bound, 6 x 9 inches, 471 pages. Published by McGraw-Hill Book Co., 330 W. 42nd St., New York 36, N. Y. Price, $7.

AIR POLLUTION HANDBOOK

Thirty-one specialists contributed material for the 14 sections that make up Air Pollution Handbook, edited by Paul L. Magill, senior scientist; Francis R. Holden, senior chemist; and Charles Ackley, editor, all of Stanford Research Institute.

(*Continued on page* 162)

SAVE WITH THESE STANDARD DESIGNS

Drawing on its long and varied experience in manufacturing heat exchangers, ADSCO has standardized the designs of many of its U-bend heaters and coolers. In this standardization program, production costs have been reduced, while the performance ability of the exchangers has been maintained. The result is high ADSCO value with the benefits of standardization passed along to customers.

TANK SUCTION HEATERS
Viscosity of heavy oils and other liquids is reduced by heating so they can be pumped economically. Only liquid to be pumped is heated, eliminating steam waste.

OIL PRE-HEATERS
Highest performance is obtained from fuel oil by heating it properly for complete combustion in burner. Work done by pre-heaters permits use of heavier grade, less costly fuel oil.

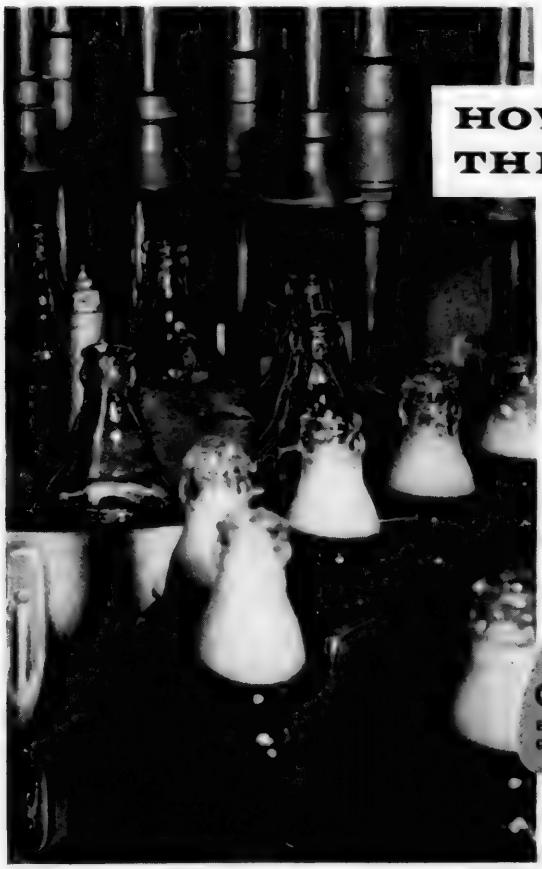
CONDENSATE COOLERS
As condensate coolers or waste-heat reclaimers, this equipment transfers otherwise wasted B.T.U.'s to other fluids which must be heated, thus effecting substantial savings.

STORAGE WATER HEATERS
Wide choice of tank materials offered, including solid or clad corrosion-resistant metals, or steel with phenolic resin lining. Of welded construction, in vertical or horizontal types. Removable heating elements of copper U-tubes.

INSTANTANEOUS WATER HEATERS AND CONVERTORS
For heating water for process work or for showers and washrooms. As convertors, these heaters are used for space heating. Of simple U-bend design with removable element.

ADSCO HEATERS AND COOLERS

AMERICAN DISTRICT STEAM DIVISION
ADSCO INDUSTRIES, INC.
20 MILBURN ST. BUFFALO 12, N. Y.



HOW DOREX STOPPED THE TROUBLE A-BREWING

Scene: A famous Brewery. Neighboring plants include a copper mill, paint factory and paper mill — all contributing to a localized air pollution problem.

Problem: Beer flavor was being affected by polluted air. So much so that when the wind was in a certain direction, the brewery was forced to suspend operations — sometimes for days at a time.

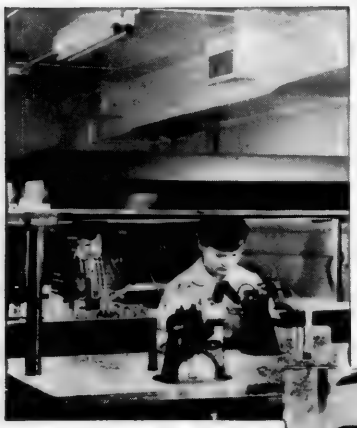
Solution: Dorex Air Recovery was installed in the air conditioning system to purify air coming into the bottling room. This proved so successful that a second Dorex installation was made in the chilling room to prevent possible contamination at that point. *Dorex has completely eliminated shutdowns due to air pollution.*

If your operations require pure uncontaminated air, investigate Dorex Air Recovery. In addition to clearing up the immediate problem, Dorex can also substantially reduce costs of installing and operating an air conditioning and ventilating system. Write us for full information. Connor Engineering Corporation, Dept. B-116, Danbury, Connecticut.

CONNOR ENGINEERING CORPORATION
dorex® air recovery

A NEW more reliable air conditioning method

with exact moisture control FOR YOUR PROCESS OR PROTECTION FOR TESTING PRODUCTS OR MATERIALS AT ANY TIME OF THE YEAR



Assembling Electronic Parts

Packaging Food Products

● This Niagara "Controlled Humidity" method gives you the **MOST EFFECTIVE** Air Conditioning because its cooling and heating functions are made completely separate from adding or taking away moisture. This assures you always a precise result. No moisture sensitive instruments are needed.

Drying Industrial Material

MOST FLEXIBLE. You can reach and hold any condition in response to instrument settings, or vary it as you wish.

EASIEST TO TAKE CARE OF. The machine is accessible, the control circuits are simple and easy to operate, and there are no solids, salts or solutions to be handled.

MOST COMPACT. It does a very large amount of work in a small space.

INEXPENSIVE TO OPERATE. At normal atmospheric temperatures (unlike systems that use refrigeration to dehumidify) it needs no summer re-heat.

Write for Bulletins 112 and 122

NIAGARA BLOWER COMPANY

Dept. HV 405 Lexington Ave. New York 17, N. Y.

Niagara District Engineers in Principal Cities of U. S. and Canada

(*Continued from page* 160)

Each section is independent of the others in the book and it treats a single aspect of the broad problem of air pollution.

The book tells what is known about air pollution, how to apply this information, and it indicates where further research needs to be done. The problem of air pollution is increasing in magnitude because of the trend towards urbanization and greater industrial concentration which in turn has led to congestion in residential areas. Both the public and industry are aware of this situation.

The sections in this handbook cover air pollution sources and their control: city planning, industrial plant location and air pollution; chemistry of contaminated atmospheres; physics of the atmosphere; evaluation of weather effects; visibility and air pollution; epidemiology of air pollution; effects of air pollutants on farm animals; effect of air pollution on plants; sampling procedures; analytical methods; experimental test methods; equipment and processes for abating air pollution; air pollution control by legislation.

Air Pollution Handbook, edited by P. L. Magill, F. R. Holden and C. Ackley. Cloth bound, 6 x 9 inches, 720 pages. Published by McGraw-Hill Book Co., 330 W. 42nd St., New York 36, N. Y. Price, $15.

STANDARD FOR AIR CONDITIONING LARGE BUILDINGS—The Air-conditioning and Refrigeration Institute has issued Standard 530 for air conditioning multi-zone buildings such as factories, office buildings and similar structures in which varying degrees of cooling and humidity must be maintained. It is a complete revision of a standard issued in 1947 by the Air Conditioning and Refrigerating Machinery Association, a predecessor of ARI. Air-Conditioning and Refrigeration Institute, 1346 Connecticut Ave. N.W., Washington 6, D. C.

ASTM TESTS FOR PETROLEUM PRODUCTS—The significance of the various ASTM methods of tests related to petroleum products is covered in the third edition of Special Technical Publication No. 7-B on Significance of ASTM Tests for Petroleum Products. Each chapter discusses a particular property or characteristic, covering the importance of sampling, selection of test apparatus, the methods of test which apply and their significance. American Society for Testing Materials, 1916 Race St., Philadelphia 3, Pa. Price, $2.50.

APPLICATION OF HEAT TO DOMESTIC GAS STORAGE WATER HEATERS—As the result of research sponsored by the Committee on Domestic Gas Research of the American Gas Association. Research Bulletin 71 has been issued on Application of Heat to Domestic Gas Storage Water Heaters. The report analyzes the water heating process to produce findings which point the way toward improving performance of domestic water heaters without seriously increasing size or cost, and minimizing service difficulties. American Gas Association, 420 Lexington Ave., New York 17, N. Y. Price, $2.

Screw Machine Products Plant, Aluminum Co. of America, Lancaster, Pa. This modern, windowless building is equipped with 49 All-Aluminum Burt Low Type Roof Ventilators.

Aluminum Co. of America Licks Ventilation and Oil Mist Problem with Burt Low Type Ventilators!

THE PROBLEM

The modern building design selected for Alcoa's new Screw Machine Products Plant is practically free of wall openings. Its 200,000 square feet of floor space has no cross circulation or natural ventilation. Production operations create considerable heat and oil mist.

THE SOLUTION

Forty-nine 48" all-aluminum Burt Low Type Roof Ventilators are used to maintain a pleasant working atmosphere the year around. Oil mist is scarcely discernible. Twenty-five of the Burt ventilators supply air. The remaining twenty-four function as exhaust ventilators.

COMPARATIVE COST

The high volume air supply utilized here is relatively inexpensive. According to the Alcoa Staff Engineer for Air Conditioning, the initial cost of air supplied by the Burt Low Type Roof Ventilators is less than one-fourth that of a centralized duct system.

SUGGESTION

If you are looking for fresh air at low cost, investigate Burt complete line of modern, efficient roof ventilators.

Send for FREE Data Book

Write for Burt Data Book SPV-101-E. It supplies quick data on Burt's complete line of modern Roof Ventilators.

FAN & GRAVITY VENTILATORS
LOUVERS
SHEET METAL SPECIALTIES

The Burt Manufacturing Company
49 E. South St., Akron 11, Ohio
Member Power Fan Manufacturers Association

In 99 Park Avenue, the last word in most up-to-date building methods and materials, as in other of the nation's newest, most modern office buildings and industrial plants,

Fairbanks Valves fill the specs.

FAIRBANKS VALVES

Proven to give longer service under difficult operating conditions, proven lower in maintenance costs!

99 Park Avenue

notable addition to the Manhattan skyline. New York City's first aluminum-faced skyscraper. A great construction achievement by the Tishman Realty & Construction Co., Inc., 445 Park Avenue, New York 22, New York. Architect: Emory Roth & Sons. Consulting Engineer: W. R. Cosentini & Associates, New York. Heating, Ventilating & Air Conditioning: Raisler Corporation, New York. Plumbing: John Weil Plumbing Corp., New York. Sprinkler: Raisler Corporation.

Men who know valves best specify and order Fairbanks Valves. For these men have learned that Fairbanks Valves insure trouble-free control of water, steam, gas, or oil. They know that Fairbanks Valves are engineered, designed, and manufactured to the highest standard of the industry. And they know that Fairbanks Valves fill their every requirement, for Fairbanks makes the complete line of bronze and iron body valves. YOURS Without obligation, send for Fairbanks Valves Brochure, describes, with cutaways, complete line of Fairbanks Valves.

THE FAIRBANKS COMPANY
393 Lafayette Street, New York 3, New York
[illegible] New York 3, Boston 10, Pittsburgh 22, Rome, Georgia
[illegible] DARI & Pic Unions • Trucks • Castings • Wheels

MERCURY-TO-MERCURY SWITCH
requires no service—contacts never pit, burn or corrode.
PERMANENT ALNICO MAGNET
links water level with electrical controls; prevents failure of mechanical linkages.
CORROSION-RESISTANT FLOAT
is made of 304 Stainless Steel for long, trouble-free service. Can also be made of special materials for extreme local conditions.
NO-SCALE FLOAT CHAMBER LINER
"flexes" off scale; prevents float "sticking".

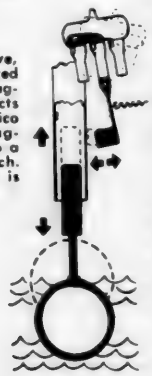
Here's "Low Maintenance"

BOILER SAFETY

MAGNETROL

BOILER WATER LEVEL CONTROLS

"Blow-down" the float chamber once-a-shift; inspect the switches once a month—that's all you have to do to keep a Magnetrol in tip-top *safe shape.* It's made that way. The secret is all in the simple magnetic operating principle *as pioneered and perfected by Magnetrol.*



A magnetic sleeve, raised and lowered within a nonmagnetic tube, attracts or repels an Alnico permanent magnet attached to a mercury switch. Basically, this is Magnetrol.

Standard Magnetrol Units are available for pressures to 600 psi and temperatures to 750°F., for single or multi-stage control with as many as three separate switching actions. Also special units for more extreme requirements. For full details, mail coupon.

MAGNETROL, Inc.

MAGNETROL, INC., 2106 S. Marshall Blvd., Chicago 23, Ill.
Gentlemen: Please send me Catalog Section III and full information on Magnetrol Boiler Water Level Controls.

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AIR CONDITIONING RESEARCH

(*Continued from page 148*)

level in the several fields of human and animal environmental physiology, refrigeration and air conditioning.

Professor W. E. Fontaine, of the Purdue School of Mechanical Engineering, briefly outlined engineering research performed at the university so far in this area, including such studies as analysis of sources of noise in air conditioners, adhesion of ice to surfaces, studies on heat transfer characteristics of numerous liquid and gaseous refrigerants, and calculations of heat transfer in soils, including possible heat pump applications.

Professor F. N. Andrews, of the University's Department of Animal Husbandry, described the school's environmental physiology research to date, including studies in which it was proved that even minimal cooling of swine during summer months increases their rate of gain significantly and that sheep, which normally breed once a year, can be induced into an extra breeding period by changing day length and environmental temperature.

• **TECHNICAL COMMITTEE**—Dr. Morgen introduced the technical committee in charge of the Research Center, which includes Prof. Harry L. Solberg, head of the School of Mechanical Engineering, chairman; Dr. Norman Volk, associate director of the Agricultural Experiment Station; Dean of Engineering George A. Hawkins (represented at the meeting by Associate Dean Paul F. Chenea), and Prof. George A. Spencer, head of the School of Agricultural Engineering.

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each of the rear quarter panels, the intake now is a take-off from the fresh air duct in the engine compartment. A valve allows fresh air to bypass the heater and flow through the outer rocker panel by means of a tube which connects with ductwork concealed within the car's body.

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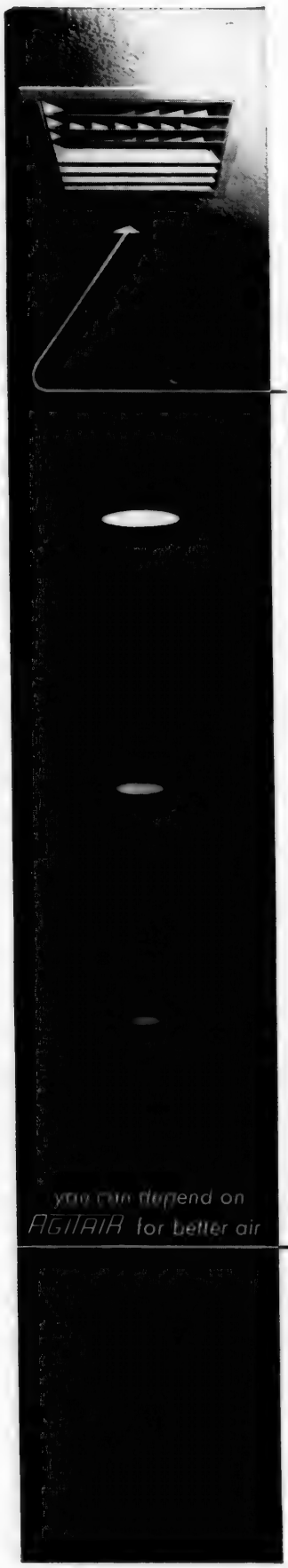

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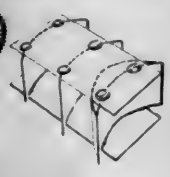

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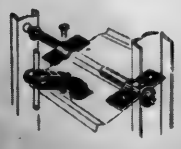

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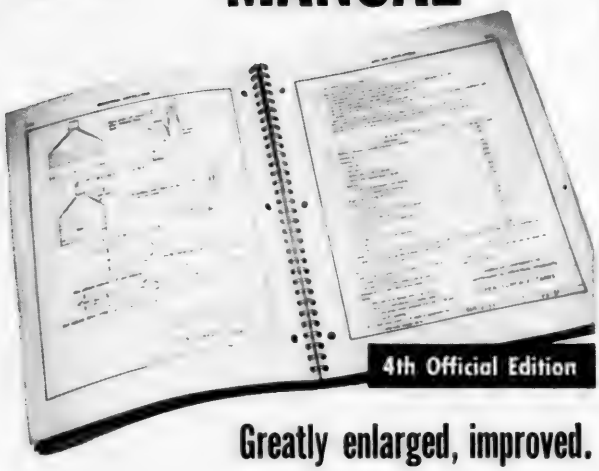

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PACKAGED WATER CHILLERS

(*Concluded from page* 95)

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York Corp. (Fig. 12). Flooded horizontal shell and finned tube cooler is mounted below a shell and finned tube condenser. Capacity reduction in compressor is available to permit efficient part load operation with a corresponding reduction in power requirements. Oil is continuously and automatically returned to the compressor.

COMING EVENTS

Where listed, names or titles of individuals are those from whom further information is available

REFRIGERATION ENGINEERS CONVENTION—Annual convention of the Refrigeration Service Engineers Society, at Hotel Muehlbach, Kansas City, Mo. H. T. McDermott, International secretary of the Society, 433 No. Waller Ave., Chicago, Ill. ..... **NOVEMBER 15-18, 1956.**

ASRE CONVENTION—Semi-annual meeting of the American Society of Refrigerating Engineers, at Hotel Statler, Boston, Mass. Secretary of the Society, 234 Fifth Ave., New York 1, N. Y. ..... **NOVEMBER 25-28, 1956.**

ASME MEETING—Annual meeting of the American Society of Mechanical Engineers, Hotel Statler, New York, N. Y. Secretary of the Society, 29 W. 39th St., New York, N. Y. ..... **NOVEMBER 25-30, 1956.**

REFRIGERATION CONTRACTORS CONVENTION—Annual convention of the Refrigeration and Air Conditioning Contractors Association, at the Balmoral Hotel, Miami Beach, Fla. Secretary of the Association, 10660 Carnegie Ave., Cleveland 6, Ohio. ..... **NOVEMBER 26-28, 1956.**

POWER SHOW—The 22nd National Exposition of Power and Mechanical Engineering, under the auspices of the ASME, at the New York Coliseum, Columbus Circle, New York, N. Y. E. K. Stevens, International Exposition Co., 480 Lexington Ave., New York 17, N. Y. ..... **NOVEMBER 26-30, 1956.**

CHEMICAL EXPOSITION—9th National Chemical Exposition of the American Chemical Society, in the Cleveland Public Auditorium, Cleveland, Ohio. Secretary of the Chicago Section of the Society, 86 E. Randolph St., Chicago, Ill. ..... **NOVEMBER 27-30, 1956.**

WARM AIR HEATING CONVENTION—Annual convention and committee meetings of the National Warm Air Heating and Air Conditioning Association, at the Netherland Plaza Hotel, Cincinnati, Ohio. George Boeddener, managing director of the Association, 145 Public Square, Cleveland 14, Ohio. .... **NOVEMBER 27-30, 1956.**

AIR POLLUTION MEETING—Semi-annual meeting of the Air Pollution Control Association, at the Rice Hotel, Houston, Tex. H. C. Ballman, executive secretary of the Association, 4400 Fifth Ave., Pittsburgh 13, Pa. ..... **DECEMBER 3-5, 1956.**

SOLAR ENERGY SYMPOSIUM—Two-day symposium on solar furnace design and operation, sponsored by the Association for Applied Solar Energy, in conjunction with Stanford Research Institute, Arizona State College and the University of Arizona, to be held at the Hotel Westward Ho, Phoenix, Ariz. J. I. Yellott, secretary of the Association, 3424 N. Central Ave., Phoenix, Ariz. ..... **JANUARY 21-22, 1957.**

PLANT MAINTENANCE SHOW—Eighth National Plant Maintenance and Engineering Show at the Public Auditorium, Cleveland, Ohio. Clapp & Poliak, Inc., 341 Madison Ave., New York 17, N. Y. ..... **JANUARY 28-31, 1957.**

(*Concluded on page* 168)

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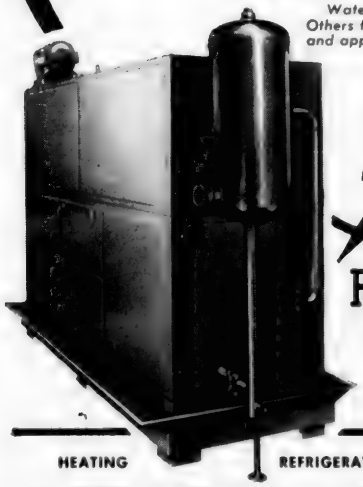

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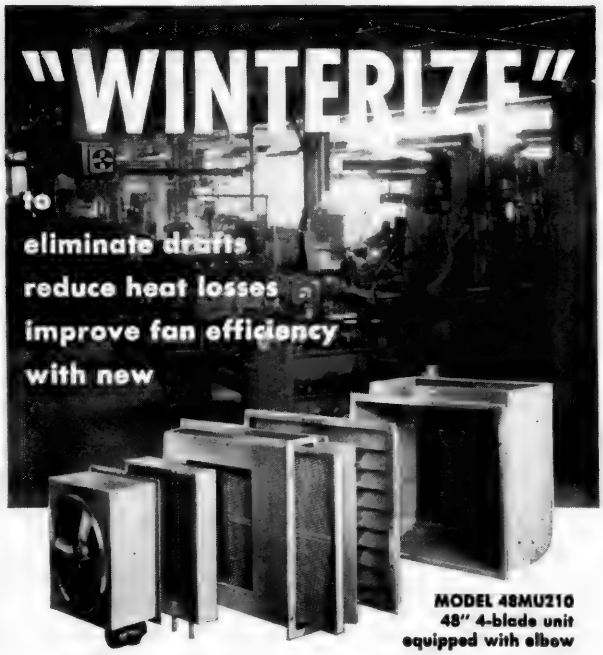

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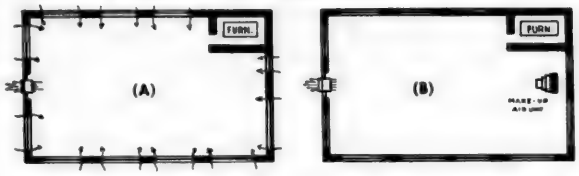

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(Concluded from page 166)

INDUSTRIAL VENTILATION CONFERENCE—Sixth annual Industrial Ventilation Conference, to be held at Kellogg Center, Michigan State University, East Lansing, Mich. Public relations department of Michigan State, E. Lansing, Mich. ..... **FEBRUARY 18-21, 1957.**

ASHAE MEETING—63rd annual meeting of the American Society of Heating and Air-Conditioning Engineers, Inc., at the Conrad Hilton Hotel, Chicago, Ill. A. V. Hutchinson, executive secretary of the Society, 62 Worth St., New York 13, N. Y. ..... **FEBRUARY 25-28, 1957.**

HEATING AND AIR-CONDITIONING EXPOSITION—13th International Heating and Air-Conditioning Exposition, at the International Ampitheater, Chicago, Ill. E. K. Stevens, manager, International Heating and Air-Conditioning Exposition Co., 480 Lexington Ave., New York 17, N. Y. ..... **FEBRUARY 25-MARCH 1, 1957.**

CORROSION ENGINEERS MEETING— 13th annual conference and exhibition of the National Association of Corrosion Engineers, at Kiel Auditorium, St. Louis, Mo. A. B. Campbell, executive secretary of the Association, 1061 M & M Building, Houston 2, Tex. ..... **MARCH 11-14, 1957.**

ATOMIC ENERGY CONFERENCE— Fifth conference on Atomic Energy in Industry, sponsored by the National Industrial Conference Board, at the Benjamin Franklin Hotel and Convention Hall, Philadelphia, Pa. Public information department of the National Industrial Conference Board, 460 Park Ave., New York 22, N. Y. ..... **MARCH 14-15, 1957.**

METALS CONGRESS AND EXPOSITION—10th Western Metal Congress and Exposition, sponsored by the American Society for Metals, and other technical groups, at the Pan-Pacific Auditorium and the Ambassador Hotel, Los Angeles, Calif. W. H. Eisenman, managing director of the Society, 7301 Euclid Ave., Cleveland 3, Ohio. ..... **MARCH 25-29, 1957.**

GAMA MEETING—Annual meeting of the Gas Appliance Manufacturers Association, at The Greenbrier, White Sulphur Springs, West Va. H. Leigh Whitelaw, managing director of the Association, 60 E. 42nd St., New York, N. Y. ..... **APRIL 8-10, 1957.**

REFRIGERATION INSTITUTE MEETING—Annual meeting of the Air-Conditioning and Refrigeration Institute, at The Homestead, Hot Springs, Va. Executive secretary of the Institute, 1346 Connecticut Ave., N. W., Washington, D. C. ..... **MAY 6-8, 1957.**

MECHANICAL CONTRACTORS MEETING—Annual meeting of The Mechanical Contractors Association of America (formerly Heating, Piping and Air Conditioning Contractors National Association) at the Hotel Fontainebleau, Miami Beach, Fla. L. B. Gruman, Jr., secretary of the Association, 30 Rockefeller Plaza, New York 20, N. Y. ..... **MAY 7-10, 1957.**

DESIGN ENGINEERING SHOW—Design Engineering Show to be held at the Coliseum, New York City. Clapp & Poliak, Inc., 341 Madison Ave., New York 17, N. Y. ..... **MAY 20-23, 1957.**

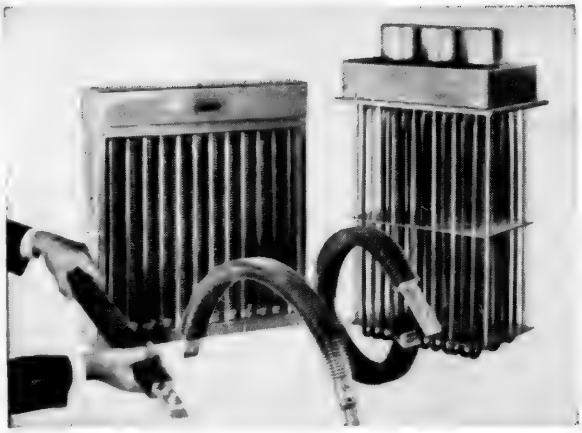
NDHA MEETING—48th annual meeting of the National District Heating Association, at The Homestead, Hot Springs, Va. J. F. Collins, Jr., secretary-treasurer of the Association, 827 N. Euclid Ave., Pittsburgh, Pa. ..... **JUNE 3-6, 1957.**

TESTING MATERIALS MEETING—60th annual meeting of the American Society for Testing Materials, at the Chalfonte-Haddon Hall, Atlantic City, N. J. Secretary of the Society, 1916 Race St., Philadelphia 3, Pa. ..... **JUNE 16-21, 1957.**

ASHAE MEETING—Semi-annual meeting of the American Society of Heating and Air-Conditioning Engineers, Inc., at Murray Bay, Quebec. A. V. Hutchinson, executive secretary of the Society, 62 Worth St., New York 13, N. Y. ..... **JUNE 24-27, 1957.**

CIVIL ENGINEERS EXHIBIT—Annual meeting and Civil Engineering Show of the American Society of Civil Engineers at Hotel Statler, New York, N. Y. Secretary of the Society, 33 W. 39th St., New York 18, N. Y. ..... **OCTOBER 14-18, 1957.**

AIR-CONDITIONING AND REFRIGERATION EXPOSITION — 10th exposition of the Air-Conditioning and Refrigeration industry, sponsored by the Air-Conditioning and Refrigeration Institute, at Chicago's International Amphitheater, Chicago, Ill. Secretary of the Institute, 1346 Connecticut Ave., N. W., Washington 6, D. C. ..... **NOVEMBER 18-21, 1957.**



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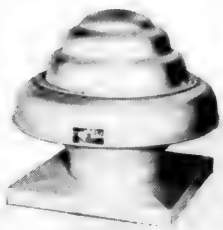

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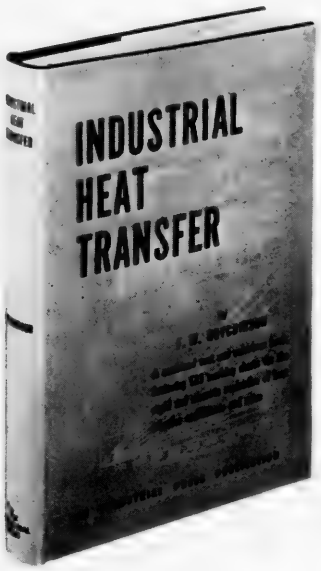

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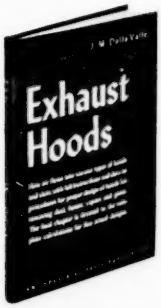

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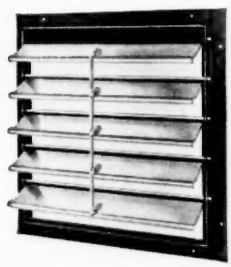

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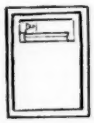

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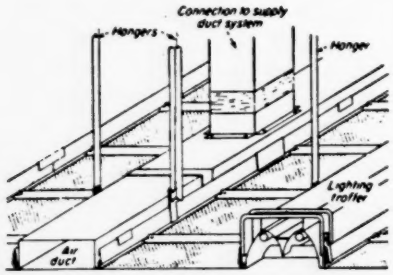
- Effective noise reduction.
- Immediate action—no uncomfortable time lag on either heating or cooling cycle.

All for little more than the cost of a quality suspended ceiling alone.



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ALPHABETICAL INDEX OF ADVERTISERS

A

Aerofin Corp. 13
Aerovent Fan Co., Inc. 167
Air Devices, Inc. 165
Allen, W. D. Manufacturing Co. 171
Allis-Chalmers Manufacturing Co. ... 14
American Air Filter Co., Inc. 19-21, 38-39, 48
American Blower Corp. 40
American District Steam Div., Adsco Industries, Inc. 161
American Gilsonite Co. 17
Anderson, V. D., Co. 156
Anemostat Corp. of America 47, 171
Armstrong Machine Works 67

B

Babcock & Wilcox Co., Boiler Div. 141
Barber-Colman Co. 143
Bell & Gossett Co. 63
Bethlehem Steel Co. 66
Binks Manufacturing Co. 158
Bishop & Babcock Mfg. Co. 54
Bituminous Coal Institute 43
Burt Manufacturing Co. 163
Byers, A. M., Co. 9

C

Carrier Corp. 15
Chase Brass & Copper Co. 18
Chicago Pump Co. 76
Classified Advertisements 170
Committee on Industrial Ventilation .. 166
Connor Engineering Corp. 161
Coyne & Delany Co. 11
Crane Co. 16

D

Debothezat Fans Div., American Machine & Metals, Inc. 1
Dravo Corp. 153
Drayer-Hanson Div. National-U. S. Radiator Corp. 168
Dunham-Bush, Inc. 45

E

Elgen Manufacturing Co. 165
Elgo Shutter & Mfg. Co. 171
Elliott Co., Crocker-Wheeler Div. ... 145

F

Fairbanks Co. 163
Farr Co. 68
Field Control Div., H. D. Conkey & Co. 75
Frick Company 155

G

General Chemical Div., Allied Chemical & Dye Corp. 51
Grinnell Co., Inc. .....Inside Front Cover
Gustin-Bacon Manufacturing Co. ..150-151

H

Halstead & Mitchell 46
Hartzell Propeller Fan Co. 56
Henry Valve Co. .....Inside Back Cover

I

Illinois Engineering Co. 77
Infra Insulation, Inc. 7
Inland Steel Co. 28-29

J

Jenkins Bros. 41
Jenn-Air Products Co., Inc. 34
Johnson Service Co. 22-23
Joy Manufacturing Co. 70

K

King Zeero Co. 159
Koppers Co., Inc. 69
Kramer Trenton Co. 53
Kritzer Radiant Coils, Inc. 59
Kuhns Brothers Co. 152

L

Lawler Automatic Controls, Inc. 72
Lewin-Mathes Co. 37

M

Magnetrol, Inc. 164
Marsh Heating Equipment Co. 60
McDonnell & Miller, Inc. .....Back Cover
Minneapolis-Honeywell Regulator Co. Insert bet. 16-17, 30-31
Modine Manufacturing Co. 154, 157
Mueller Climatrol 50

N

Nash Engineering Co. 80
National Tube Div., United States Steel Corp. 58
Nelson, Herman Div., American Air Filter Co. 38-39
Nesbitt, John J., Inc. 149
New York Blower Co. 62
Niagara Blower Co. 162
Novelty Steam Boilers Works, Inc. 33

O

Orr & Sembower, Inc. 36

P

Patterson-Kelley Co., Inc. 4
Penn Ventilator Co. 169
Petro 61
Pittsburgh Plate Glass Co. 78
Powers Regulator Co. 26-27
Prat-Daniel Corp., Thermobloc Div. 169

R

Rigidbilt, Inc. 167

S

Sarco Co., Inc. 57
Sarcothern Controls, Inc. 35
Simplex Ceiling Corp. 172
Skidmore Corp. 71
Spence Engineering Co., Inc. 74
Sporlan Valve Co. 79
Standard Stamping & Perforating Co. ... 49
Stoddard Industries, Inc. 167
Synchronous Flame, Inc. 149

T

Thermobloc Div., Prat-Daniel Corp. 169
Trane Co. 24-25

U

Unistrut Products Co. 65
United States Steel Corp., National Tube Div. 58
Universal Diffuser Corp. 160

W

Wagner Electric Corp. 52
Walworth Co. 64
Want Advertisements 170
Webster, Warren & Co. 2
Weil Pump Co. 159
Western Engineering & Mfg. Co. 155
Wheeling Steel Corp. 55
Weigand, Edwin L., Co. 169
Wing, L. J., Mfg. Co. 73
Worthington Corp. 32

Y

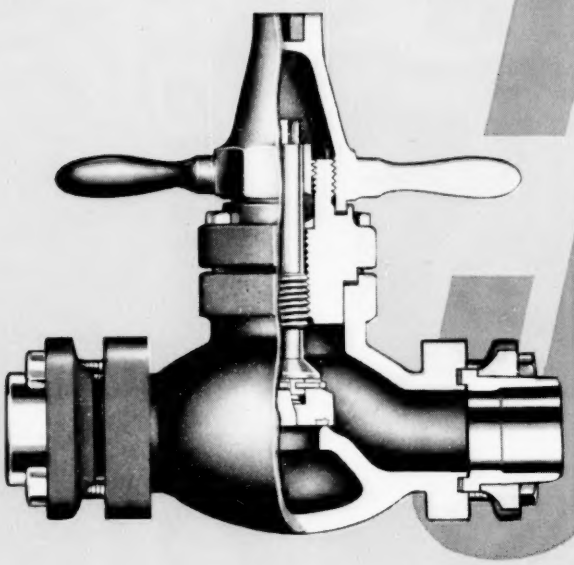
Yarnall-Waring Co. 147
Youngstown Sheet & Tube Co. 44

Z

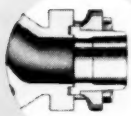
Ziegler, G. S. & Co. 42

FIVE TYPES OF CONNECTIONS IN HENRY

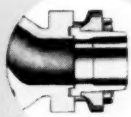
SEMI-STEEL WING CAP VALVES



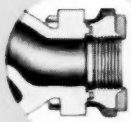
F.P.T.
In Valve Body
½" thru 2½"



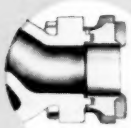
O.D. Solder
Brass Adapter
and Steel Flange
1⅜" thru 5⅛"



Steel Butt Weld Adapter
and Steel Flange
1¼" thru 5"



One Piece F.P.T. Flange
1¼" thru 6"



One Piece Slip-on Weld Flange
1¼" thru 6"

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For example, steel pipe can be screwed directly into the valve body on sizes thru 2½", or it can be screwed into one piece F.P.T. flanges on sizes 1¼" thru 6". It can also be butt welded to separate steel adapters with companion flanges or used with one piece slip-on weld flanges in the same larger size range. If copper pipe is used, separate brass O.D. solder adapters with companion flanges permit soldering or brazing.

BRONZE BODY VALVES all have O.D. solder connections.

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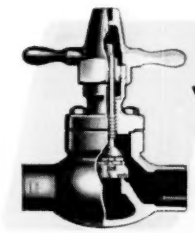

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Made of bronze alloy to meet government specifications. Compact design—relatively light weight. Bolted bonnet construction and heavy wall bodies for maximum strength and safety. O.D. solder connections machined in valve body. Size range: ⅞" thru 4⅛" globe type; ⅞" thru 3⅛" angle type.

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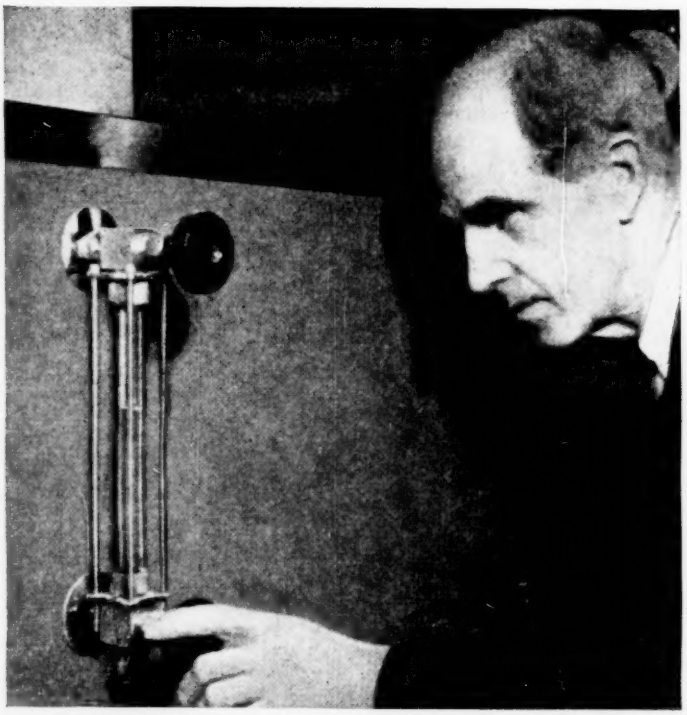

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